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ABSTRACT

This guide contains a collection of activities which are designed to provide opportunities for 4-H voluteers and youth in New Jersey to get involved in learning about the marine environment. The guide is divided into five sections which deal with habitats, organisms, career exploration, community involvement, and additional marine activities. Each of the sections is comprised of individual lessons, with the intention of including the necessary information for volunteers to provide marine education for 4-H youth. Each lesson is further broken down into seven categories: (1) an introduction; (2) the goals of the lesson; (3) background information; (4) preparation reminders; (5) questions for discussion; (6) additional resources and ideas; and (7) references. The appendices contain reproducible worksheets for use with various lessons and activities, a field trip planning guide, project requirement guidelines, record keeping information, and lists of additional resources. (TW)

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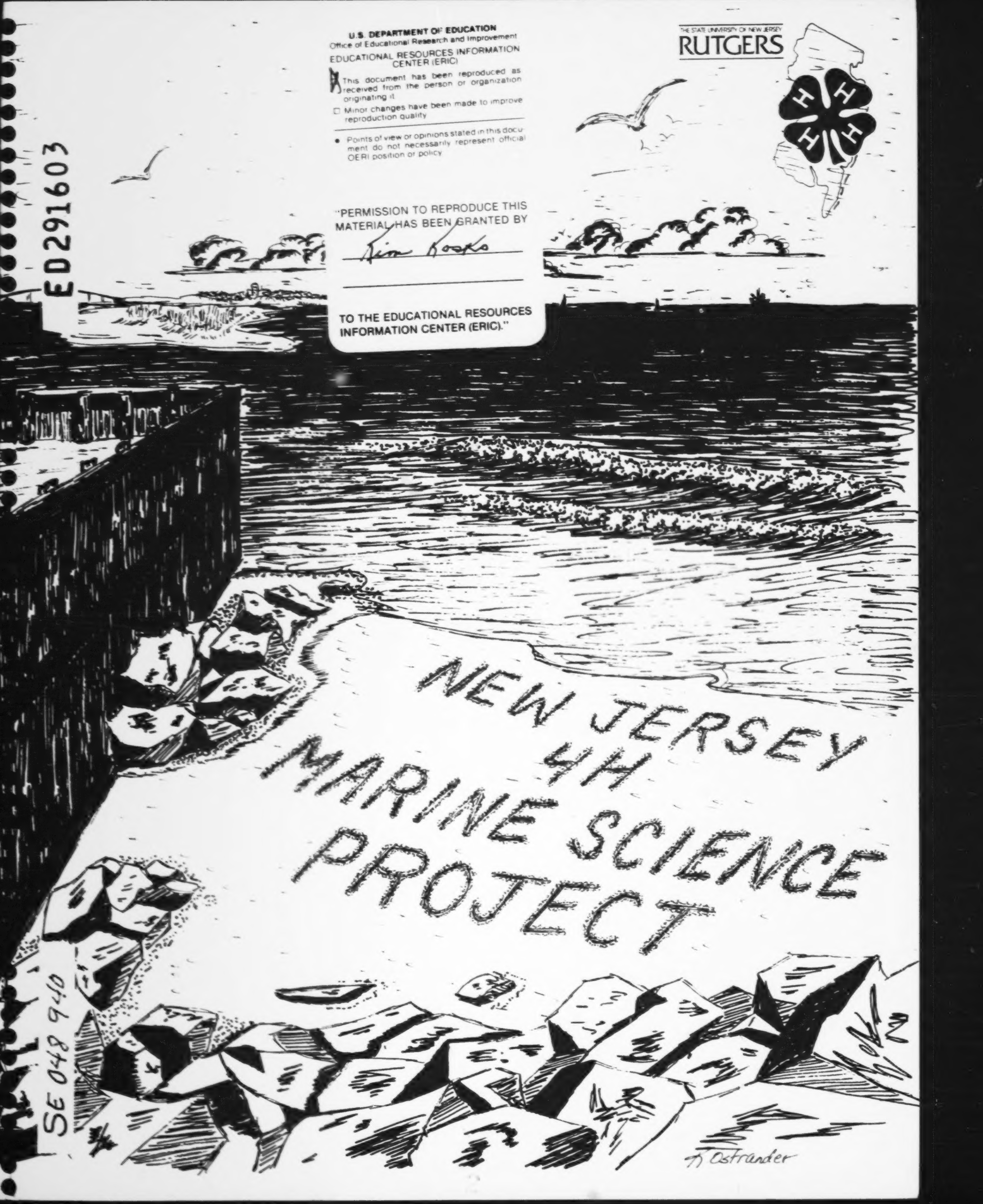

NEW JERSEY 4H MARINE SCIENCE PROJECT

SE 048 940

4-H
MARINE SCIENCE PROJECT

LEADERS GUIDE

compiled by
Betty Jean Jesuncosky
County 4-H Agent
Department of 4-H Youth Development
Cooperative Extension
Cook College - Rutgers University
1987

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B.J. Jesuncosky

NEW JERSEY
MARINE SCIENCES
CONSORTIUM

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INTRODUCTION

Each year the New Jersey shore attracts millions of tourists to bask in the sun on our sandy beaches and swim in the cooling surf. Although many visit our extensive and attractive coastline, few people are aware of the real value of New Jersey's Marine resources.

While New Jersey residents enjoy the benefits of abundant marine resources we also face the challenge of addressing many serious issues related to management and wise use of the marine and coastal environment.

Educating our youth is the key to providing the knowledge and understanding necessary to make critical decisions affecting the future of our marine resources.

The focus of this project is threefold:

-to help 4-H youth learn to understand the natural processes and value of our marine environment.

-to help 4-H youth enjoy and feel an appreciation of our natural resources.

-to help 4-H youth develop personal skills such as decision making, communicating and feeling positive about themselves while learning about marine resources.

As a 4-H Leader you play an important role in seeing that youth have the opportunity to learn, grow and have a positive experience in 4-H. You help them to set project goals as well as personal goals through club meetings, events and activities. You pave the way for a child to want to know about the world around him. You will feel proud as your 4-H members learn and develop through this project. Enjoy the activities along with your 4-H members. Approach it as a total experience limited only by your own imagination and interest.

The New Jersey 4-H Marine Science project is a unique collection of activities which provide an opportunity for 4-H volunteers and youth to get involved in learning about the marine environment in a wide variety of ways.

The guide is divided into color coded sections covering the following topics.

Section I - Habitats
Section II - Organisms
Section III - Career Exploration
Section IV - Community Involvement
Section V - Additional Activities

Each of these sections is composed of individual lessons including the necessary information for volunteers to provide marine education for

4-H youth through fun, learn by doing activities.

Each lesson is further broken down into seven categories. These categories and their functions include:

- -Introduction - The value or objectives in teaching the lesson.
- -What your 4-H Members Will Learn - Project goals for the lesson.
- -Background Information - Terms and narrative providing marine science information for the leader to teach the lesson. Prior scientific knowledge is not necessary, 4-H leaders can learn right along with the group.
- -Preparing For The Meeting - What the 4-H leaders need to do prior to the meeting to prepare for the lesson.
- -Involving The Members - Questions for discussion, various activities to be completed by the members. Activities may be completed at one or more meetings. Access to the shore is not required for the majority of the activities, they can be done in any area.
- -Additional Resources and Ideas - Where to go for more information, additional ways to get involved in the topic of the lesson.
- -References - Bibliography entries providing information on where the information contained in the lesson can be found.

The final two sections of the guide are; Appendix I containing worksheets for use with various individual lessons and activities. The worksheets are not numbered and are printed on white paper for easy reproduction on a copy machine so that each 4-H club member can receive one. Appendix II contains various help for the 4-H Leader. Items included are field trip planning guide, project requirement guidelines and record keeping information, lists of additional resources and notes concerning references.

Planning is a very important part of any 4-H project. Guiding your members in planning is an important part of your role as a 4-H leader. Begin your club's participation in this project by determining which topics and activities appeal to your members.

Within this project you have a lot of freedom to cover topics in whatever order you wish. You will find that your members are interested in many of the activities, field trips and topics.

Design your club's participation to include a well rounded 4-H experience. Because the lessons in this project may be completed basically in any order you may want to take a sampling of each section to vary the activities and topics covered. The number of activities included will provide enough varied activities to design a well rounded 4-H experience for the members for several years.

Lessons included under each section range from those for the beginner to those for the more experienced member. When choosing activities, gear the lessons to the interest and experience level of your club's members.

As a 4-H leader you are crucial to the success of the 4-H program. 4-H club meetings and project work provide an exciting opportunity to help youth learn, grow and achieve.

With your help 4-H members will have a chance to acquire knowledge and skills, gain a sense of accomplishment, and develop a positive attitude toward themselves and others.

How successful you are will depend on your ability to relate to the members individual needs, your willingness to allow members to be creative and learn from you as well as each other, and your ability to assume the role of a helper and coach while providing education. Does it sound like a big job? It is, but with big satisfactions in helping kids have fun, grow, and learn.

The next step is getting started. Review the activities offered, discuss planning with potential members and 4-H professionals in your county, and jump in the water is fine!

SECTION I

Habitats

THE BEST PLACE TO LIVE

Introduction

All plants and animals have a home. The environment which surrounds an organism has an important affect on how it lives.

The beach is an interesting home for many plants and animals.

In this lesson 4-H members will be introduced to the concept of habitat. They will discuss environment and what elements are essential to life as well as look at the beach as a habitat.

What Your 4-H Members Will Learn

. about environment and its importance to life
. the elements of a habitat
. the characteristics of the beach environment

Background Information

. **Environment** - surroundings
. **Habitat** - the area or natural environment in which an organism normally lives and grows
. **Beach** - the sandy areas along the shore where the land and water meet.

The habitat of an organism is the place where it lives. Various elements are important to the survival of an organism in its habitat.

Habitat is an important concept to understand in marine science because it will help 4-H members know where to go to find organisms for further study.

An example...

If you wanted to get to meet a person in our human community you would need to know his address or where he could be found. To really get to know that person, however, you would want to know something about his job, his interests, friends and how he lives in his community. It is the same way in the marine community, learning the habitat of an organism is just the beginning. To study organisms we must learn more about how they live. Each habitat supplies organisms that live there with just the right amount of water, air, food, light, heat and protection. The beach provides an interesting variety of habitats because of the shifting sands, changes in water levels and exposure to wind and sun.

Preparing For The Meeting

To prepare for the following activity you will just need to be familiar with the background information. Read it over and present the lesson to your club members. Discuss the concepts of habitat and environment. To prepare for this activity collect various pictures of places where people and animals live. Include a picture of the beach.

Involving The 4-H Members

Discuss various places that people and animals live. What elements of a habitat do these areas provide? Compare various habitats both human and animal. What is the environment in each habitat? Discuss living on the beach. Talk about the habitats that can be found on the beach. What elements necessary for survival does the beach provide?

Activity

Materials needed:

. colored construction paper
. glue
. white paper
. crayons
. paints
. pencils, etc.

After discussing habitats, ask your 4-H members to think about living on the beach. If they had to live there how would they live?

Have them imagine that they are an organism on the beach and draw a picture of their environment. Where would they choose to live? What kind of organism are they? How would they live?

Have members explain their picture to the group.

Mount the pictures on colored construction paper.

The pictures made in this activity can be used for future exhibits or entered in your local county fair or similar event.

Additional Resources And Ideas

Take a walk outside in your yard or neighborhood. What habitats do you see?

What other organisms share your environment?

Draw a picture or write a story about your habitat and environment.

References

Odum, Eugene P. **Fundamentals of Ecology**. Philadelphia: W. B. Saunders Co., 1955.

LIFE AT THE BEACH - BEACH ZONATION

Introduction

The beach is an exciting area to explore in the 4-H Marine Science Project. As a habitat it has distinct physical and chemical characteristics which provide a unique environment for plants and animals living there. In this lesson, 4-H members will be introduced to the concept of beach zonation as well as learn about the characteristics of various areas of the beach.

What Your 4-H Members Will Learn:

. the names of various areas of the beach
. the physical and chemical characteristics present in each zone of the beach

Background Information

Zonation - divisions of a marine or coastal area with similar environmental characteristics and species groups

Species - category of organisms

Organisms - living plants and animals

Beach - sandy areas along the ocean constantly changing in size and shape due to wind, waves and tides

Habitat - the area or natural environment where a plant or animal lives

The beach is a sandy area along the coast where the land and ocean meet.

It is an ever changing environment where it's shape and size is affected by wind, waves, and tides. The beach can be divided into zones which are determined by the condition of the water, air, light, and the species groups in the area.

These zones are called the Dune area, Fore beach, Intertidal area, and Sub-tidal area. Each of these areas are the home of a variety of organisms which are adapted to live in that particular environment. Each habitat supplies the organisms that live there with just the right amount of water, air, food, light, heat and protection.

Each of the organisms living on the beach have special physical features which are designed to best use the resources available in the zone in which they live.

The following lists are each of the zones with their characteristics and examples of the organisms that live there.

Dune Area

The dune area is mostly sand. Beach sand may be pure sand or it may be mixed with small particles of broken shells or other minerals. Sand is mostly composed of the mineral quartz. The kinds of minerals and particles in sand determine its color.

New Jersey beach sand came largely from the mountains of Pennsylvania. Over the years rocks are worn down and broken into tiny pieces by the wind and water. Rivers and streams then carried the sand to the ocean. The Delaware and Schuylkill Rivers carried much of the sand which is now southern New Jersey.

The mounds of sand found on the beach are called dunes and are formed by the actions of wind on the sand. At the beach there is almost constant wind. Dunes are formed or change in shape when the wind picks up the sand a few particles at a time and blows it around. Plants on the beach trap and store sand which has blown and cause mounds to be formed. The dunes help to protect the land from the ocean and the action of the waves.

The environment of the dune area is dry, sandy and windy. All of the plants and animals living in this area are especially equipped to survive under these conditions.

Examples of organisms living in this area include: dune grasses, poison ivy, rabbits and insects.

Fore Beach (also referred to as fore dune)

This zone is the flat sandy area found after the dunes as you walk to the ocean. It is the most harsh of the zones. Because this area is above the high tide line it is in general extremely dry. The fore beach is barren and provides no protection from the affects of wind and sun. Organisms found in this area include beach hoppers, ghost crabs and insects. In this zone you will also find skate or whelk egg cases, shells and other debris. Although the organisms related to these finds do not live in this zone, this area is where many materials gather.

Intertidal Zone

The area of the beach between the high and low tide line may be called the intertidal zone. The constant pounding of waves and alternating exposure to air and salt water caused by the tides would seem to make this area a difficult environment for survival, and at first glance this zone may appear to be barren and lifeless. In reality, the intertidal zone is the habitat for many interesting organisms. Because of the changing environmental conditions, many intertidal organisms are not readily visible. This area is also an excellent place to find seashells washed in by the waves.

Animals living in this zone include; hermit crabs, sand crabs, worms, horseshoe crabs, sand dollars and fiddler crabs.

When looking at this area of the beach you will also often see birds. Although the birds do not live in this zone, the organisms living here provide an excellent source of food. Birds along the shore include sandpipers, skimmers, herring gulls, terns, etc.

Sub-Tidal Zone

This zone is located beyond the lowest tide line and marks the beginning of the marine environment. This area may have some overlap with the intertidal zone. Organisms living in this area are constantly underwater and must have the capacity to breathe in this environment. Some of the organisms in this zone include; sea anemones, starfish, clams, snails, various types of crabs, mussels, sea lettuce, skate, jellyfish and finfish.

Preparing For The Meeting

To prepare for this lesson become familiar with the background information. You may want to get a book from the library which shows the beach. Included in Appendix I, at the back of this book, is a zonation chart for use in identifying organisms that may be helpful.

Using the information provided, introduce the concept of zonation to your 4-H club members. Focus on each zone as a habitat or a place for organisms to live. You may want to have members close their eyes and think about the beach. Many libraries have records or tapes of beach sounds available. These may be used to set the tone for this lesson. Choose an activity from those listed below. Be sure to gather all materials before the meeting. You may want to also try out the activity beforehand to help things go smoothly.

Involving The 4-H Members

Discuss the beach. What is on and in the different zones of the beach? What colors, textures, sounds, smells, shapes? What animals and plants are there? What type of movement?

Discuss what they as humans do in each zone.

Activity I Beach Zonation Mural

Materials needed:

- large paper, newsprint or four sheets of poster board
- water colors, crayons, pencils, etc
- black or brown marker

Have members make a mural of the beach designating each zone. This may be done in a large group or members may be divided into smaller groups and assigned a specific zone. This activity may also be done individually on a small scale.

Have members focus on the physical characteristics of each zone.

Complete the activity by looking at the entire mural and reviewing each zone.

Hint: If you use 4 sheets of poster board be sure to put them together first to draw the shore and horizon lines.

This mural can be used as a backdrop for a club display. Specific organisms may be added to complete the display.

Activity II Exploring Beach Sand

Review the activity sheet located in Appendix I entitled "Exploring Beach Sand".

4-H members may work in groups or individually.

Give each member/group materials needed.

Following the steps on the activity sheet have members complete each of the steps.

Materials needed:

- exploring beach sand activity sheet
- paper cups
- a bucket of sand (beach sand is preferable but builder's sand will work).
- white paper
- magnifying glass
- magnet
- quart jar with lid
- small bowl

Each member/group receives a quart jar, sheet of paper, a cup of sand and one cup of water to work with. Items like the magnifying glass, magnet and bowl may be shared throughout the group.

Activity III Beach Walk

You may want to go to a beach to get a "firsthand look" as an activity in this section.

Check the information on field trips contained in this guide to plan your activity.

When on the beach consider:

- What shades of blue do you see?
- What shades of brown do you see?
- What other colors do you see?
- Close your eyes. What different sounds do you hear? What odors can you smell?
- What shapes do you see?
- How many textures can you feel?
- What kinds of movement do you see?
- What can you find on the beach?

Using the activity sheet "Beachcombing Worksheet" have members discuss, write down, or draw what they find on the beach.

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THE MOTION OF THE OCEAN - TIDES AND WAVES

Introduction

New Jersey has an extensive shoreline. More than one-sixth of our land area is classified as coastal. Two important factors affecting our coast are tides and waves. In order to study the coastal and marine environment it is important to understand these concepts. Understanding waves and tides is also very important to safely participate in activities near the ocean.

In this lesson, 4-H members will be introduced to very basic information about tides and waves and begin to understand their importance.

What Your 4-H Members Will Learn

. what causes tides and waves
. how to find out about high and low tides
. the importance of waves and tides to man and the environment

Background Information

Tides - change in the water level in the ocean and bay. High tide is when the water covers much of the area of the beach. Low tide, when the water is lower and more of the beach is exposed.

Waves - churning or disturbances of the water's surface caused mostly by winds and tides.

Tide Table - chart used to determine the times of high and low tide each day.

Some people live inland and have scarcely heard of tides. People living on the shore however know very well what tides are and how important they are.

Tides and waves behave in similar ways. They are what keep the ocean in motion.

Tides are the ocean water's response to the pull of the Moon's gravity and to a lesser degree the more distant Sun's gravity. They are the ocean's longest waves. Tides can be simply explained as waves that occur approximately every twelve hours and 25 minutes. Waves are a churning or disturbance of the water's surface. The wind causes most of the wave action at our shore. A wave can be as small as a ripple or larger, even as large as tidal waves. All waves have a crest or high point, a trough or low point and a valley between the crests.

When waves are occurring it appears that the water is coming in to shore but it is actually moving in a circular motion. The water actually moves forward, down and then backwards as a wave moves.

Tides and waves have been a moving force in the seas for as long as the seas have been on earth.

Tides carry in materials and organisms at high tide. Areas affected by tidal action are filled with life. Tides and waves also help to keep coastal areas clean. If tides stopped flowing pollutants would accumulate and poison coastal areas. These materials are however carried out to sea.

To safely participate in activities at the beach and bay where tides occur it is important to know about high and low tides and when they will occur.

We use tide tables to determine the times for high and low tides at specific locations along the New Jersey coasts. The tide table presents the projected daily high and low tides for these locations computed from observation of local changes and the effects of phases of the Moon and position of the Sun. The resultant tidal predictions are those expected under average weather conditions. Therefore the actual tides you observe may deviate from the prediction due to extreme weather conditions. Changing position of the Earth in relation to the Moon and Sun will also cause variations in the daily heights of high and low tide.

Additional information from your specific area can be added to determine the actual time of high and low tide. This information is important in navigation and also in fishing.

Tides and waves are very important because they replenish life, serve to help keep coastal areas clean, affect navigation and generally keep the ocean in motion.

Preparing For The Meeting

Review the background information provided. Plan to present this information as simply as possible. You might want to check the newspaper for predicted tide times and share the information with club members. Identify the daily difference in tidal heights and encourage them to observe the extreme tidal range in their local area. Tide tables for your use are also available through your Cooperative Extension Office or from local marinas, bait and tackle shops or Chamber of Commerce. For more information on Tide Tables refer to Appendix I activity sheet entitled "Using A Tide Table".

Choose one or more of the activities included in this section to demonstrate the forces involved in wave and tide formations to your club. Be sure to go over the activity before the meeting and test the activity so that it will run smoothly.

Involving The 4-H Members

Have members think about waves and their movement. Discuss the beach at high tide and low tide. Discuss tides and waves with your members.

Discuss:

1. How are tides important to habitats at the beach?
2. What are tides and how are they caused?
3. How are tides and waves important to man?
4. What can happen to a seaman if he fails to check his tide tables?
5. Could knowing the time of high and low tide be helpful in catching fish?
6. In Beachcombing?

Activity I Making Waves

The purpose of this activity is to examine some of the movements of waves.

Materials needed:

- a pan or basin
- water
- a straw

Set up an experiment to determine the cause of waves.

1. Fill a pan half full of water.
2. Blow into a straw over the surface.
3. Observe what happens as you blow harder.

Discuss the following questions:

1. What was formed as you blew into the straw over the surface of the water?
2. What effect did blowing harder have on the surface of the water?
3. What blows across the surface of the ocean water?
4. Can it form waves? Explain.
5. What kind of waves would a storm cause? Why?

Making Waves Again

Set up another experiment to determine the cause of waves.

1. Using the same pan of water, place the pan on a table.
2. Pound lightly on the table underneath the pan.
3. Pound heavily on the table to show the effect of seafloor disturbances such as earthquakes, volcanoes, etc.
4. Observe the results.

Discuss the following questions:

1. What happened as you pounded on the table?
2. What effect would these waves have as they reach the beach?
3. Could we harness waves as a source of energy? Explain.

Activity II Waves Move But Not The Water

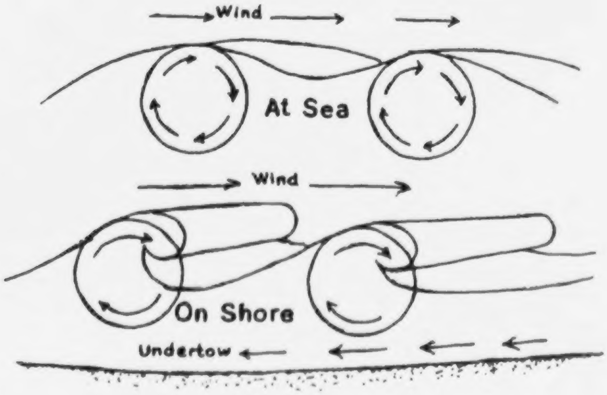
Set up an experiment to demonstrate that when a wave occurs the water itself is not traveling forward. This experiment may be done in a pond, pool, tub of water, or an aquarium.

Materials needed:

- a cork or piece of paper
- a stone

1. Drop a stone in a pond or large container of water (the larger the better) and watch the waves.
2. When the water is still again, place a cork or piece of paper in the water. Drop another stone in the water. Observe the cork.
3. How does the cork move?
4. Repeat the experiment and watch the cork closely. The cork will bob up and down, backward, forward and down again as each wave passes under it.

5. Water particles are moving in a circular pattern or back and forth but they are not moving forward. What is being passed on is the motion itself. This is a chain reaction much like a row of dominoes falling down in succession after one is pushed.



Wave movement

Activity III Finding Out About Tides

This exercise is to help understand how tides are caused and how tides are different in various areas.

Materials needed:

- a quart jar
- a pint jar
- water

With your club members follow the following instructions:

Put the water in the jar. Then swirl it around and around, until you get it to move smoothly in a circular motion without splashing all over the place.

What you have just done is create a mini-tide. The motion of your hand is the action of the Moon and the Sun on the tides. The sides of the glass or jar are the edges of the continents. The smooth motion of the water as it swirls around in the jar is the tide itself.

If you watch closely, you will notice that the motion of the water has a rhythm. It moves around and around at the same rate all the time. If you make the jar move slower or faster, the water will stop moving in this rhythm, and will start to splash all over the place again.

This is also what happens in the ocean. Each body of water is in some way enclosed. The enclosed part of the body of water is in what is called a basin. Each basin has its own natural rhythm and physical boundaries that determine loal tides. The Moon and the Sun act on the water in each basin in the way that we have been talking about. Then the tides flow back and forth, according to the natural rhythm of each basin.

Get a different size jar or glass. Put some water in it, and swirl it around. Is the natural rhythm of this container different from the first one? Try changing the amount (depth) of this water. Is it different now?

Every ocean and sea acts this way. Almost nowhere will you find high tides and low tides that are exactly 12 hours and 25 minutes apart. Even though the Moon and the Sun always pull and push on the water with this rhythm, the natural rhythm and the depth of each basin has the ability to determine exactly how far apart the tides will actually be.

From tide tables in newspapers or from observation determine the range water height difference from low to high tide for your local area. Observe the rise and fall of tides on docks or bridge supports. What is the range of your local tides? Is it the same for all areas? Where is the most greatest tidal range on the East Coast of the United States? (Bay of Fundy?)

References

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LEARNING MORE ABOUT WAVES

Introduction

Humans love to sit on the beach and watch the waves roll into the shore. We would like to think that we could learn about waves from watching their motion, but we often can not. Waves are relaxing and often we catch ourselves daydreaming. If you do not think so try to sit on the shore and count one hundred waves.

In this lesson we will not count waves but 4-H members will learn about waves, their action and their importance to marine study.

What Your 4-H Members Will Learn

. about the cause and actions of waves
. to recognize the parts and types of waves
. to understand their relationship to the marine environment

Background Information

Wave - churning or disturbance on the water's surface
Crest - high point of a wave
Trough - low point of a wave

Defined simply, waves are a churning or disturbance of the water,s surface. There are several forces which result in this type of disturbance. Earthquakes and volcanic eruptions can cause very large waves, traveling thousands of miles across the ocean, called tsunamis. When these waves reach land, they can be extremely destructive. The Sun's and Moon's gravity pulls on the Earth's waters causing the longest waves of all - the tides. Wind, however, is the most common force stimulating wave formation.

A wave can be as small as a ripple or as great as the destructive tsunamis. Some scientists believe that ripples are very important to the formation of bigger waves. They provide a surface which the wind can both push and pull as it moves across the water. All waves have a crest or high point and a trough or low point, the valley between crests.

When we watch a wave, it looks as though the water in the wave is moving across the surface of the body of water. Actually, if we could see individual bits of water or particles of water, we would see that they move in a circular motion. There is very little forward movement of the water. The water actually moves forward, down, and then backwards as the crest and trough pass. What we actually see moving across the water surface, in the form of waves, is the energy passed on from the disturbance which caused the waves to form.

This is true except in breakers. In breakers, the water does move with the waves. As waves near shore, they begin to move through shallower water. Now, they are influenced by the bottom over which they pass. The wave begins to "drag" on the bottom, decreasing the energy available for forward motion. The wave length and speed decreases and the wave height increases. Like a tower of building blocks, it becomes increasingly unstable. The "tower" of water collapses over the front of the wave on its way to the beach. These collapsing waves are called breakers. Scientists have identified four basic types - spilling, plunging, collapsing and surging.

Why is understanding waves and their behavior so important? Obviously, waves and their movement can and do influence navigation. They must be given consideration in the design and construction of ships. The design and construction of shoreline structures, such as docks, jetties and bridges are influenced by waves. Scientists use wave data to predict the formation of storm waves, their direction, speed, and possible impact on the shoreline. Probably the most important effect of waves is that which they exert on the shore.

Waves carry sand, sediments, and soil away from the beach (erosion) and to the beach (deposition). These processes, erosion and deposition, go on all the time. To what degree is dependent on many factors including the nature of the shore, the nature of the shallow water bottom, geological features, wave speed, and so on.

An excellent opportunity to see the effects of wave erosion and deposition is presented by observing a beach during the winter season and the summer season. Winter waves are stronger; they transmit more energy. This means they can carry a great deal of sand away from the beach. Summer waves, on the other hand, transmit less energy. By the time they reach the beach, much of their energy is spent and there is not enough left to carry as much sand away. In fact, more sand is deposited on the beach during summer months.

Whether or not we are aware of it, waves have a great impact on our environment and activities. The activities included in the wave investigation present an opportunity to understand more about how and why.

Preparing For The Meeting

Read the background information provided in this lesson. Read it carefully before presenting it to your 4-H members.

Choose an activity to illustrate waves and their motion. One of the options in this section is a field trip to the ocean. Before attempting this activity consult the field trip planning guide in this booklet for help in preparation.

Involving The 4-H Members

1. Discuss waves and their motion.
2. What types of waves have your 4-H members seen?
3. Share stories about the ocean and waves.
4. Discuss the importance of waves in the marine environment.
5. What impact do waves have on intertidal organisms?

Activity I The Wave Machine

To illustrate the motion of waves construct a wave machine.

Materials needed:

- empty glass half gallon jar (rectangular, clear sides, tight fitting lid)
- rubbing alcohol
- mineral spirits
- blue food coloring

Fill the empty jar half full with rubbing alcohol. Add three drops of blue food coloring to the alcohol. Fill the remaining space with mineral spirits (try not to leave an air space at the top). Cap tightly with the lid. Lie the jar on its side and you have a wave machine.

Activity II Wave Types

Organize a field trip to the beach. Consult the Field Trip Planning Guide in this booklet.

Using the activity sheet entitled "Wave Types" conduct the field experience examining wave shapes and movement.

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LEARNING MORE ABOUT TIDES

Introduction

Tides play a very important role in learning about the marine and coastal area. To safely and effectively participate in boating, fishing, clamming and beachcombing, an understanding of tides is essential.

In this lesson 4-H members will learn how tides are caused and how to use a tide table.

What Your 4-H Members Will Learn

- how tides are caused
- how to use a tide table to determine tides in your area
- the importance of tides in various aspects of marine related activities

Background Information

Tides - The alternate rising and falling of the surface of the ocean occurring twice daily over most of the Earth.

Gravity - The force which pulls objects toward each other.

High Tide - The crest (highest point) of the wave going halfway around the Earth caused by the pull of the Moon's gravity.

Low Tide - The trough (lowest point) of the wave going halfway around the Earth caused by the pull of the Moon's gravity.

Centrifugal Force - The force acting to move objects outward when a body is rotating or revolving rapidly around a center.

Tidal Range - The difference in height between high and low tides for one location.

Ebbing - Outgoing tide.

Flooding - Incoming tide.

Neap Tide - Tides with a smaller than average tidal range which occur about every 14 days around the time of the first and last quarter Moon.

Spring Tide - Tides with a larger than average tidal range which occur about every 14 days near the time of the full and new Moon.

Apogee - The point in the orbit of the Moon when it is farthest from the Earth.

Perigee - The point inthe orbit of the Moon when it is nearest to the Earth.

Nearly everyone has visited a coastal beach and noticed the gradual, daily change in water level along the shore. These changes are called tides and are caused by the gravitational pull of the Moon and Sun on the Earth's surface. Gravity is the attraction between bodies. The Earth's gravity keeps the Moon in orbit around the Earth, while the Moon's gravity causes tides on the Earth. The Sun's gravity holds the Earth in orbit around it and influences the tides.

The Moon's gravitational pull on the Earth causes a bulge in the ocean on opposite sides of the Earth. This bulge is actually a huge wave that travels over the Earth. The crest (top) of the wave is high tide, while the trough (bottom) of the wave is low tide. While the water directly under the Moon is pulled toward it, the Earth is pulled away from the water on the opposite side. The result is high tides on sides of the Earth opposite the Moon and low tides on sides of the Earth at right angles to the Moon.

The rotation of the Earth on its axis also affects the tides by increasing the bulging effect on the ocean through centrifugal force. Objects moving in a circular path tend to move outward from the center of movement. Remember the last time you were sitting in a car making a sharp turn? You were thrown to the side. This is an example of centrifugal force. Likewise, the ocean is thrown outward from the Earth's surface by the spinning motion of the Earth.

The Earth's rotation on its axis causes the huge tidal bulges on the ocean's surface to travel over the Earth. This usually results semidiurnal tides or two high tides and two low tides each day for any one place. However, due to the irregular shape of the continents and the ocean basin, many coastal areas have fewer daily tides or extremes between high and low tide levels. The tidal range is the difference between high and low tide levels. The Great Lakes in the United States and the Mediterranean Sea in Europe have tidal ranges of only a few inches. The Bay of Fundy in Nova Scotia has a tidal range of over 40 feet.

The ebbing (outgoing) and flooding (incoming) tides often produce strong currents, especially in channels, rivers, and inlets. The ebbing tides remove sediments and carry nutrients from the shoreline. The flooding tidal currents bring in fresh food supplies and fresh seawater.

Refer to the activity sheet "Using a Tide Table" in Appendix I, you will notice that the tides run about 50 minutes later each day. This is because the Moon revolves around the Earth as the Earth rotates on its axis. During the time the Earth completes one rotation (24 hours), the Moon has traveled more than 54,000 miles in its orbit around the Earth. If a given point on the Earth is directly under the Moon, it takes approximately 24 hours and 50 minutes for it to pass under the Moon again. You have probably noticed that the Moon appears in the same place in the sky about 50 minutes later each evening.

The daily changing water levels of high and low tides, are caused by the Sun. The Sun also influences the tides, but since it is so far from the Earth, its effect is much less than that of the Moon. When the Sun and Moon line up on the same or opposite sides of the Earth, their gravitational pull on the Earth combines and the tidal ranges gradually increase. Called spring tides the high tides are higher than average and the low tides are lower than average. Spring tides occur during new and full Moons. The tide table indicates approaching spring tides. When the Sun and Moon are at right angles to the Earth, their gravitational pull is spread over the Earth. The result is a below average tidal range. The high tides are not very high and the low tides are not very low. These are called neap tides and occur during quarter Moons.

Information about the tides has always been of great importance to navigation, especially in guiding ships in and out of harbors and operating in shoal waters near shore and around islands. In time of war, a knowledge of the tides of a particular area is essential before an amphibious operation can be planned where boats, men and materials have to be landed along some distant shore. Tidal information is also used in designing plants for generating electricity with tidal energy.

Preparing For The Meeting

The concept of tides is very complex and sometimes difficult. Be sure to read the background information carefully. Refer to the activity sheet entitled "Tides" in Appendix I at the back of this book. Choose an activity for your meeting. Read the activity carefully and try it out beforehand.

Involving The 4-H Members

Discuss:

1. What are some problems coastal residents and boating enthusiasts must face when living and working in areas with extreme tides?

2. What are some benefits of tidal currents to marine organisms? Food? Oxygen? Salt? Larval Movement?

3. What are some hazards of strong tidal currents to swimming and fishing enthusiasts?

Activity I What Causes Tides?

In this activity your members will be setting up an Earth-Moon model. This experiment will help 4-H members understand the concept of the center of gravitation important in understanding what causes Tides.

Materials needed:

- yardstick
- volleyball (or any ball of similar size) (represents Earth)
- tennis ball (represents the Moon)
- heavy string

Attach the two balls to the yardstick at opposite ends with the heavy string.

By balancing the stick on your finger, locate the center point between the balls at which the stick will stay balanced and level. This point will be much nearer the large ball than it is to the small ball. Tie a piece of string tightly around the stick at this point. Then hang the stick by the piece of string. The point that you have located is the center of gravitation. If you were to cut the stick in half where it is tied with the string and weighed each end, along with the balls that are attached to each end, they would weigh the same amount.

The real Earth and Moon have a center of gravitation, however unlike the model, it is located inside the Earth.

The Earth and Moon both rotate around this center of gravity which makes the Moon appear to move around the Earth.

If you grasp the stick where it is tied and turn it gently, you can make the Earth-Moon model rotate around its center of gravitation.

As the model moves you will notice that instead of hanging straight down the models of the Earth and the Moon lean outward. The faster the model spins the further out they lean. Centrifugal force is pushing the models apart. Everything that spins around and around experiences this force, including the real Earth and Moon. Instead of being held together by a stick though, they are held by gravity. Centrifugal force causes a bulge of water on the side of the Earth opposite the Moon.

Even though the Moon does not cause the whole Earth to move toward it, it does attract the water on the side nearest to it. This causes the second tidal bulge.

Activity II Centrifugal Force

The following activities will help your 4-H members understand centrifugal force.

Materials needed:

. heavy grade balloon
. a small bucket with a handle
. water

Fill the balloon with water until it is the size of a soft ball. Do not fill it to the bursting point. Place the balloon on a smooth, wet surface and spin it with a hard twist of the wrist.

Discuss what happens to the shape of the balloon and why.

Next, fill the bucket with water to a depth of two or three inches. Holding it by the handle, swing it briskly up and over your head. Make sure that there are no obstructions in your way and do not stop during the swing or the water will spill out. What holds the water in the bucket? Discuss centrifugal force and how it holds the water in the bucket.

Activity III Using a Tide Table

Refer to the activity sheet in Appendix I entitled "Using a Tide Table". Working with this information, have 4-H members calculate the tides in your area or any designated area for an upcoming day of your choice.

Additional Resources

Your library will have additional books on tides if your members are interested in further study.

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COASTAL WETLANDS "HOW IMPORTANT ARE THEY!"

Introduction

Along New Jersey's coastline, between the sea and the mainland lies an area of salt marshes and tidal waters known as the Wetlands. Our coastal wetlands are an important natural resource which requires protection. In this lesson 4-H members will become familiar with the characteristics, function and importance of coastal wetlands.

What Your 4-H Members Will Learn

. the characteristics of the wetlands
. organisms located in this area
. the importance of the wetlands as a natural resource

Background Information

Estuary - an area where the salt water of the sea and the fresh water of rivers and streams meet and mix.
Silt - material consisting of fine particles of rock, sand and soils which can be carried and deposited by water.
Detritus - tiny pieces of dead grass, food for many animals in the wetlands.
Salt Marsh - area where cord grass grows. Low grassy areas flooded by tides twice daily.
Ecosystem - living organisms and non-living substances interacting to procure products which benefit or affect both the living and non-living inhabitants.

Our coastal wetlands are made up of estuaries and salt marshes. Coastal wetlands are a combination of water and land. These areas are protected from strong wave action and usually have soft muddy bottoms. In this area freshwater from the upland area meets the salt water of the sea. Sand and silt settle out, filling creeks and building mud flats.

The wetlands are very important for several reasons. The complex ecosystem of the wetlands has many functions. It serves as a buffer zone with a great capacity for absorbing high tides; it serves as a filter to resolve and remove many pollutants brought in with the tides, it serves as a breeding ground, nursery or feeding ground for many fish and marine organisms, it is a home for numerous species of wildlife and a recreation area for man.

Estuaries have a rich supply of food and the built in protection from predators which makes it a haven for small organisms.

Some animals such as worms, oysters, barnacles, snails and mussels spend their entire life in an estuary. Other animals such as shrimp and blue crabs only spend a part of their life in the estuary. The rest of their time may be spent in either the fresh water of the river or salt water of the ocean. The extensive mud flats of coastal areas host a variety of mud dwelling organisms which burrows into the soft bottom of wetland areas.

Preparing For The Meeting

Read and familiarize yourself with the information included in this section. An activity sheet entitled "The Wetlands" is included for use with this lesson. Look it over and be sure that you understand the concepts. Choose an activity from those listed, gather the needed materials and try it out to be sure it moves along smoothly.

Involving The 4-H Members

Discuss the wetlands. What wetland areas have your members seen? What do wetlands look like?

Activity I - Coastal Wetlands of New Jersey

The purpose of this activity is to look at the coastal areas in New Jersey.

Materials needed:

. diagram of New Jersey (Activity Sheet)
. ball of string
. ruler
. road map of New Jersey

1. Using a piece of string outline the state from Bergen down to Cape May, then around to Burlington County. Because the Delaware River is a tidal as far north as Trenton, the lower western side of the state can be considered coast.

2. Using a ruler measure the string and, based on the map's scale of miles, compute the number of miles.

3. Instruct the members to study the map, noticing the differences in the shape of the various sections.

4. Focus their attention on the differences between sections. Use a road map, as well as the map in the book.

Section C is a short, north pointing finger of land.

Section E is a long, narrow south pointing stretch of land with water on three sides.

Section F is a series of islands.

Sections A,B,D,G, and H are continuous unbroken stretches of shoreline not separated from the mainland.

5. Collect pictures of New Jersey. The Chamber of Commerce in your county is a good source of free information as they often have illustrated brochures. Use the pictures to help you understand the physical coastal features of each section on the map.

Activity II - Filtering Water

The wetlands serves as a filter to remove and dissolve many pollutants brought in with the tide. This activity will help members understand how water is filtered. Members may work in small (3-4 people) teams.

Materials Needed

.For each team of four:
.1/2 gallon plastic bottle
.plastic measuring cup
.two clean containers (for collecting water)
.window screening, cheese cloth, or nylon net
.pantyhose material
.coffee filters
.string
.rubber bands
.ruler
.aluminum pie pan
.eye dropper or dropper
.water
.soil
.sand
.cotton

Cut the bottoms off the plastic bottles to make a large funnel capable of holding a number of layers of material.

Combine soil and water in a clear container and mix thoroughly.

Challenge members to devise a method of getting the water clean using any combination of materials furnished. Set a time limit. Provide as little additional information as possible, so as not to limit the range of creative solutions.

Note: Members should participate in a brief discussion of the goal: to separate the soil and water most efficiently, with the greatest amount of clean water collected by the simplest possible separator.

1. How does the separator actually work?

2. Is the final water really clean? What do we mean by "clean"?

3. What could cause your separator to stop working?

4. Could your separator remove food color or salt from water?

5. What are some separators in nature?

Can your members see the relationship between the size of the mesh of the filtering material and the size of the material filtered out from the water.

Try adding salt. Discuss what happens.

Additional Resources and Ideas

There are several films available on the topic of wetlands. Contact your local library for use.

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FRESHWATER

Introduction

Valuable insights can be gained in marine science through comparisons. In this lesson, 4-H members will learn about the freshwater habitats of ponds and lakes and make comparison to the marine environment.

What Your 4-H Members Will Learn

- the basic components of freshwater habitats
- types of organisms found in ponds and lakes

Background Information

Surface Film - the surface of the water
Open Water - extends from the center to the area where plants become rooted
Bottom - from the shore outward to the deepest points - may be composed of sand, mud or silt
Shore - the area around the water's edge
Littoral - area extending from the water's edge outward as far as rooted plants grow

In large lakes and ponds four habitats can be easily recognized. These include: surface film, open water, bottom and shore. Each of these areas provides a home for various animals which have distinct adaptations which make them best equipped to use the resources available in that area.

Surface Film - the habitat of air breathing or floating animals. Organisms in this area have the special capability of walking on the surface without breaking through. Some kinds of organisms are adapted to life only on the upper side of the film.

The larvae or eggs of some organisms spend much time hanging on the underside of the film. Surface dwelling organisms feed on floating plants, prey on one another, or eat insects or other animals that drown and then float to the surface.

Examples of organisms living in the surface include kinds of beetles, water bugs, free floating plants and flies.

Open Water - the area which is open. Plants which are rooted do not exist in this area. Ponds and lakes with rooted plants from shore to shore do not have an open water zone. Large, free swimming animals such as fish as well as small microscopic plants and animals that drift suspended in the water, live in this area. The drifters in this area, called plankton, vastly outnumber all of the larger pond inhabitants.

Plankton, consisting of small floating plants and animals are the basic food in ponds and lakes. Organisms in this area consist of various fish species, tiny crustaceans, rotifers and other invertebrates. Turtles, birds and large fishes frequent this area.

The Bottom - this area offers a variety of living conditions. The sandy bottoms in shallow areas may be inhabited by sponges, snails, earthworms and insects.

In quiet waters, bottoms are covered with mud or silt which contains many organic particles. Crayfish and early stages of dragonflies, mayflies and damselflies burrow into the bottom muds. In deep waters, life at the bottom is extremely different. Light does not penetrate these areas and plants do not grow. Animals cannot find protection, oxygen is low and life is very sparse. The few animals living on the bottom include earthworms, small clams and fly larvae. Bacteria is abundant in this area and it is important in returning chemicals to the life cycle.

Shore - this area is located at the water's edge and is often referred to as wetlands. In this area you can find a great number of organisms which do not live in the water but rely on its resources to live. Shore organisms include a wide variety of plants, trees, shrubs and vines, small mammals, reptiles and birds.

The Littoral Zone - extends from the shore outward as far as rooted plants grow. This area is the richest in the pond environment.

In most ponds and shallow lakes this habitat extends from shore to shore. Life in this area includes an extremely wide variety of plants and animals.

Plants include grasses, sedges, rushes, water lilies, water ferns, pond weeds, hornworts and water weeds. Many kinds of frogs, birds and mammals find food and shelter here.

Worms, snails, insects and small fishes also live here.

Preparing For The Meeting

Freshwater habitats is a broad topic to present. Be sure to read the background information to familiarize yourself with the topic. Review the activity sheet called "Freshwater Habitats". This may be used with this section to help 4-H members understand the characteristics of the freshwater environment. A field guide on Ponds and Lakes, or Freshwater areas is an excellent resource to help you to prepare for this meeting. It will give you information on aquatic plants and animals.

Involving The 4-H Members

Discuss the freshwater habitat and the characteristics of each area. How are the freshwater habitats similar to marine areas? How are they different?

Activities for this section can be chosen from those listed under marine organisms. Options include:

Potato Fish
Build A Bird
Nature Prints

When doing the above activities with this section focus on the freshwater environment and the plants and animals found in this area.

Note: The Blue Gill fish pictured in the activity sheet "Parts of a Fish" is a Blue Gill which is a freshwater species.

A field trip can also be an excellent activity for this section. Consult the information on "Planning a Field Trip" to help plan this activity.

References

Reid, George K. - **Pond Life, A Guide To Common Plants and Animals of North American Ponds and Lakes**. New York. Golden Press. 1967.

CREATING A HABITAT: THE AQUARIUM

Introduction

Setting up and maintaining an aquarium to collect and observe aquatic organisms is an exciting and educational experience. When you establish an aquarium you are duplicating the natural environment of the organisms you put in the aquarium. This lesson focuses on the aquarium as an environment or habitat and introduces 4-H members to the essentials of life for aquatic organisms.

What Your 4-H Members Will Learn:

- the essentials of life in an aquarium
- to understand the responsibility of establishing and maintaining an aquarium
- that the aquarium is an artificial duplication of a natural habitat

Background Information

All living things on the land or in water need space, oxygen, light and food. Marine creatures have an additional need, saltwater.

When you establish an aquarium you are making an effort to duplicate an organism's natural habitat in an environment where you can observe them.

When you establish an aquarium you assume the responsibility for providing the essentials of life for the organisms in your tank.

Let's take a look at how that can be created.

Space - The aquarium tank is the new space in which your organisms will live. An aquarium should not be too small. Aquatic organisms need space in which to play and exercise. A good rule of thumb for choosing the proper size aquarium is two gallons of water for every inch of fish. For example if you have five fish, each two inches long, thus 10 inches at two gallons for every inch of fish, you need a minimum of a 20 gallon tank. Metal is very poisonous to saltwater organisms, so if you are having a saltwater aquarium be sure that the tank has no metal parts.

Oxygen - In your "mini-habitat" you will need to provide oxygen. An air pump is essential to provide oxygen and keep everything running smoothly. The pump circulates the water, it ruffles the surface and allows air to dissolve at the water's surface.

Light - The health of your organisms depends somewhat on the amount of light your aquarium receives. Place your tank in a location where it receives light, but not direct sunlight. Direct sunlight will cause algae to grow too rapidly in your tank and cause a rise in temperature of the water.

Food - How often and what you feed the organisms in your tank is very important. Fish should be fed twice a day but only in small amounts. Food that is not eaten should be removed from the tank before it begins to decay. The more you can vary the diet of your organisms the healthier your animals will be. After a while you will learn which food your animals like best.

Saltwater - The question of saltwater or freshwater is a decision that you must make in establishing your aquarium. If you choose to set up a saltwater aquarium, seawater may be either synthetic or natural. Local marine life can survive quite well in water from the collection area where you got them. Filtering will clear up any particles in the water. There are instructions, however, available for making your own seawater. Do not use table salt, it does not contain the additional minerals needed for your aquarium.

Freshwater - If you choose freshwater you may also use the natural water from the pond or lake where you collect your organisms.

Preparing For The Meeting:

The information in this section is to encourage 4-H members to think about the aquarium as a habitat. It is in no way to serve as a guide for establishing an aquarium. A 4-H project book entitled "Small Oceans" is available at the 4-H Office which fully outlines how to establish an aquarium. Use this reference to properly assemble an aquarium. This information can be presented as discussion in preparation for one of the activities related to aquariums.

Involving The 4-H Members:

Talk about aquariums.

Ask the members if they have ever had an aquarium. How did it work? Compare the artificial environment of an aquarium with that of natural marine environments. What are the differences? Similarities? What other things are included in an aquarium? How do they affect the environment of organisms in your aquarium?

Activity I

As an activity in this section, you may want to plan a visit to a pet shop to look at aquarium equipment and take a look at what is available. Be sure to make arrangements with the pet shop prior to your visit.

Many people have aquariums in their homes. Find out if any of your member's families have an aquarium.

Perhaps the meeting could be held at their home.

Visit the New Jersey Marine Sciences Consortium in either Sandy Hook or Seaville, New Jersey.

Plan a visit to the Baltimore Aquarium.

Additional Resources and Ideas

Many Vo-Tech schools offer Marine Biology as a course. Contact your local Vo-Tech school and visit their facilities.

References

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SECTION II

Organisms

FINDING A NICHE - ADAPTATION

Introduction

There is an amazing abundance of life in the marine and coastal environment. The organisms living in these areas have an infinite number of body designs, colors, shapes, and behavior patterns. Each of these varied characteristics allow that creature to live in their specific environment.

In this lesson 4-H members will begin to understand how organisms adapt to their environment and secure the essentials for life in their environment.

What Your 4-H Members Will Learn

. the concept of adaptation
. the essential elements of life for which organisms have adaptations
. various characteristics of organisms for adaptation

Background Information

Adaptation - physical features of an organism that make it possible for an organism to survive in its environment.

Niche - the place where an organism is best adapted to live.

The environment is ever changing, from daily weather changes, to the changing seasons, and even greater climatic changes. When these changes occur organisms must be able to also change or leave that environment in order to survive. The word adapt means "to make fit". An organism must make itself fit the environment in which it lives and in which changes occur.

Every living thing is adapted to its particular habitat. These adaptations enable the organism to successfully use the available resources and occupy its niche in the environment.

Some of the essential elements of life for which organisms have adaptations include - movement, feeding, reproduction, protection and communication.

Other adaptations may include wide temperature tolerance, diving abilities, burrowing capabilities or migration. For instance, each spring and fall bluefish migrate along coasts and rivers in search of food and spawning sites. Blue crabs burrow deep into the mud to survive the winter. A barnacle closes its shell when exposed to air during low tide.

General adaptations make an organism more versatile and less stressed or endangered by environmental changes.

Preparing For The Meeting

To prepare for this meeting carefully read the included background information. Be prepared to present the concept of adaptation to your club members. Look over the activity included and gather the necessary materials. Be sure that you have materials organized so that things run smoothly. You may want to make a sample of the project for an example.

Involving The 4-H Members

Discuss:

What essential elements of life do organisms adapt for?
What examples of this do we see in the marine or aquatic environment?

Some examples include:

claws and filters for feeding
gills for breathing
body shape, feet - burrowing for protection
shells - for protection

Talk about some ways that human beings adapt. What do you do when it gets hot? Cold?

Activity I - Create A Creature

This activity will allow 4-H members to create their own animal which must fit into a special niche. The kinds of critters they create are only limited by their imagination. Let the members be as creative as they can, but the creature must meet all of the adaptations that are selected.

Materials needed:

. index cards
. pen
. large white drawing paper
. crayons, markers or paints, pencils

K Ostrander

Preparation - Using index cards make a set of flash cards. On one side of each of the 5 cards write one of the following. Feeding, Movement, Reproduction, Senses and Protection.

On the back of the FEEDING card write:

1. Eats off the mud flats; muddy bottom. (mud snail)
2. Eats in sea grasses. (sea turtle)
3. Food is bigger than it is. (deep sea viperfish)
4. Eats crabs. (octopus)

On the back of the MOVEMENT card write:

1. Flies like a bird in the water. (skate)
2. Walks on the bottom with finger like fins. (sea robin)
3. Uses a water propulsion system. (squid)
4. Jumps around the bottom. (scallop)
5. Floats on the surface. (Portuguese man of war)

On the back of the PROTECTION card write:

1. Looks like the rocks it lives in so it can hide. (stonefish)
2. Has poisonous spines. (lionfish)
3. Swims very fast. (tuna)
4. Produces a smoke cloud. (octopus)
5. Hides in the sand. (flounder)

On the back of the REPRODUCTION card write:

1. The male carries the eggs until they hatch. (seahorse)
2. Splits in half to form two. (starfish)
3. Grows a small bump which becomes another animal. (hydroids)
4. Lays 5 million eggs. (codfish)
5. Part of its body breaks off and swims to the surface carrying eggs or sperm. (palolo worm)

On the back of the SENSES card write:

1. Smells its food. (shark)
2. Can hear sounds 100 miles away. (whale)
3. Has headlights for seeing in the dark. (deep sea lantern fish)
4. Has feelers for finding food. (marine catfish)
5. Walks sideways. (blue crab)

Using the flash cards (the numbered answer side toward you) have each 4-H member choose a number 1 through 5 for each of the categories.

On the back of their sheet of paper have them write each of their five choices. These are the five adaptations that must be included in their creature.

After choices have been made have each member "Create A Creature" by drawing a picture. The picture should include the animal's habitat and the creature itself.

At the end of the activity have each member explain their c[illegible]ture and how it lives. Discuss the adaptations that each creature demonstrates.

Additional Resources and Ideas

Your library has additional information on various marine life. A good book on marine life will cover adaptations.

The flashcards created for the activity can also be used for members to quiz each other on various species and their adaptation.

An example under Movement:

Say- "Skate" Member replies "Flies Like A Bird In The Water" or vice versa.

References

"Create a Critter", Barry Fox, Virginia Cooperative Extension Service.

IT'S ALIVE - MARINE ORGANISMS

Introduction

The beach is an exciting place to study various organisms. Each of the organisms living in the four zones of the beach has special characteristics which make it best suited to live there.

What Your 4-H Members Will Learn

- what organisms live in each zone of the beach
- the special adaptations that organisms have to help them best use the resources available in their habitat

Background Information

Zonation - divisions of a marine or coastal area with similar environmental characteristics and species groups.

Habitat - an area where a plant or animal lives.

Adaptation - a physical feature of a plant or animal which makes it possible for an organism to survive in a specific environment.

Nekton, Benthos, Plankton - categories of sea life.

The beach is an ever changing environment. It's size, shape and conditions are constantly affected by wind, waves, the sun and tides. Each of the areas of the beach provides a home for a variety of organisms which are adapted to live in that particular environment. Each habitat on the beach supplies the organisms that live there with just the right amount of water, air, food, heat, light and protection.

Listed below are each of the zones of the beach with their characteristics, examples of the organisms that live there, and what features they have that make them best suited to that area.

Dune Area - The dune area is characterized by large mounds of dry sand formed by wind action. The environment in this area is dry, sandy and windy. Basically plants, animals, insects and birds live in this area.

Plants growing in the dune area have a special function. The roots of vegetation help to keep the dunes stable. Plants in the dune area provide protection and food for animals living in this area. Characteristics of plants in the dune area include waxy leaf coating, hair like coverings, and heavy leaves. Examples include: **bayberry, poison ivy, wax myrtle, beach plums, sandbur, switch grass and beach heather.**

Some small mammals live in the dune area. They feed on plants and have feet equipped for digging food from sand. Some examples include: **rabbits, raccoons and mice.** Insects can be found practically anywhere. Examples of some dune dwelling insects with special capabilities for living in the sand, include: **beetles, sand spiders, beach hoppers, burrowing spider, digger wasps, ants, flies and crickets.**

The dune area is an important nesting area for some shore birds. Other birds visit this area to feed on plants and insects found there. Birds along the seashore and in the dune area have varying beaks, necks and feet adapted for the ways that they get food. Birds which eat seeds in this area have strong bills for cracking seeds, a short neck and perching feet. In contrast, birds in the marsh lands have long legs for wading, a neck for fishing and a bill for spearing fish. Examples include: **seagulls, terns, sandpipers and skimmers.**

Fore Dune or Fore Beach Area - This area of the beach is flat, sandy and has no wind or sun protection. Being the harshest zone, it has very few organisms living there. Very few plants are growing in this area, those plants which do grow are characterized by growth in clumps and deep root systems. New plants growing in this area grow underground. Examples include: **sea oats, American beach grass and running dune grass.** Organisms living in this area include basically beach hoppers and ghost crabs. These creatures survive harsh conditions by burrowing or digging in the sand for protection.

Intertidal Area - This zone is located between the high and low tide line. The constant pounding of waves and alternating exposure to air and salt water caused by the tides would seem to make this zone a difficult area for survival. At first glance, this area appears to be barren and lifeless. But in reality the intertidal zone is the habitat for many interesting organisms. Because of the changing environmental conditions many intertidal organisms have adaptations which make them not readily visible.

Because of the lack of rocks and plant life in this zone many animals survive in this area by digging into the sand and living below the surface. The clams, snails, and crabs living in this area are equipped with mechanisms for burrowing to hide themselves for protection from the pounding waves.

Animals that live under the sand for protection avoid suffocation by blocking their gill openings to keep out the sand and by pumping water across their gills or expanding their gill area to get more oxygen.

Other animals in this area are dependent on highly developed methods of sensing water movements to help them follow or escape the water.

Other organisms in this zone are so tiny that they cannot be seen with the naked eye. These microscopic plants and animals swim or crawl through the water film surrounding grains of sand and actually live between them. The sand provides protection for these organisms and helps them survive changing conditions.

Animals living in the intertidal zone include **hermit crabs, sand crabs, worms, horseshoe crabs, sand dollars and fiddler crabs.**

When looking at this area of the beach you will also often see birds. Although the birds do not live in this zone, the organisms living here provide an excellent source of food. Birds along the shore include **sandpipers, skimmer, herring gull, tern, etc.**

This area is an excellent place to find seashells washed in by the waves. Shells found in this area also give you a clue to animals that live on the beach and in the sea. The number and type of shells found on the beach varies with the changes in the sea and shore. To find shells on the beach, sometimes you have to be a real detective. The animals that live in shells are the natural food for birds and larger creatures so the shell allows them to hide and have protection.

Sub-Tidal Zone - This area is below the low tide line and marks the beginning of the marine or underwater environment. Organisms living in this area must have the physical features to breathe underwater. The sea is the home of one fifth of the world's animal population. All life in the sea can be grouped into three categories: **Nekton** - strong swimmers which can move from place to place. These creatures are not affected by ocean currents or tides. They are free to move to where food is most abundant. They all chase their food, flee in danger, and cover large areas of water in their migratory journeys. Nekton organisms include **whales, fish, turtles, porpoises** and **seagulls**. **Benthos** - Organisms in this group live on the bottom of the water. Temperature, oxygen depth and the kind of bottom (mud, sand or rock) determine where they can be found. Some are attached like **oysters, barnacles, sponges** and **seaweed.** Others are free to crawl like **crabs, snails**, and **shrimp**. Still others burrow into the bottom like most **clams and worms**. **Plankton** - is the third group of sea creatures. They exist in nearly every natural body of water throughout the world in such large numbers that they are impossible to count. Most plankton are microscopic, but they are the most important sea organisms because most forms of life depend on them either directly or indirectly. Plankton drift through the water with currents and tides. Some plankton produce **plant food** which is an essential resource in the sea. Some plankton are plankton all of their lives and others are just **early, young stages** of **other sea organisms**, such as sponges, worms, mollusks and fishes.

In considering the organisms of the beach area we find a great number of creatures and lots of varieties of things to study.

Preparing For The Meeting

This section on organisms is large and should be covered in several meetings. Review the background information. You will also want to look at the section in "Habitats" on beach zonation. You may want to combine the two sections and cover each zone individually using an activity that pertains to each zone. Choose your activity according to the zone or topic covered. Be sure to go over the activities carefully and assemble all materials needed before each meeting.

Involving The 4-H Members

Discuss the organisms on various zones of the beach. Which ones have you seen?

Consider the characteristics of common organisms. What do you know about these creatures? What special adaptations do they have to live in their environment?

Show and discuss some pictures of marine and coastal organisms.

Activity I - Build a Bird

This activity can be done individually or in teams.

Materials needed:

- build a bird pattern
- scissors
- construction paper for bird parts
- glue
- paper to mount birds on

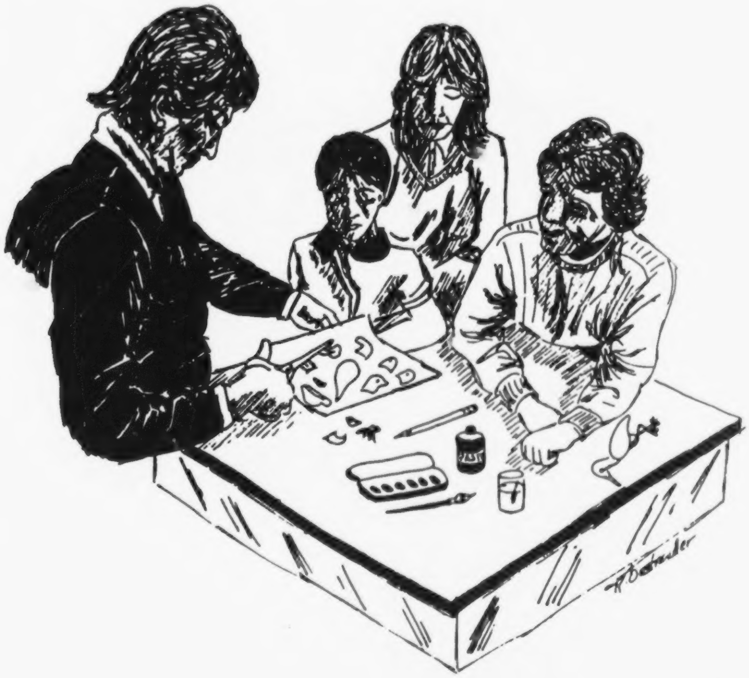
Introduce your club members to various sizes, shapes and types of shore birds from pictures or observation.

Each member or team will need a copy of the patterns for "Build A Bird" located in the activity sheets in Appendix I.

You may either give each individual or team a "Build A Bird" activity sheet and have members cut bird parts or cut a couple sets of heavier patterns for the entire group beforehand.

Have members use the patterns to trace and cut the parts of their bird out of construction paper. Members only need to cut out the bird parts that they want to use in their own creation. Have members assemble a bird from the parts they have chosen and glue it to construction paper. 4-H members may paint or draw a scene on the paper to show the bird's habitat.

It is important to discuss the various types of beaks, feet, necks, and bodies chosen and how the bird is adapted to live in a specific environment. Also discuss various species of shorebirds.



Activity II - Potato Fish

This activity is to help members learn about the external parts of a fish and show some of its adaptations.

Materials needed:

- a potato for each member
- poster board or construction paper
- scissors, crayons, tape, straight pins

Introduce the general body shape and parts of a fish using the diagram under Appendix I "Parts of a Fish".

Near the gills, the fish has pectoral fins that are equivalent to human arms. Below the gills are pelvic fins that are equivalent to human legs. An additional fin along the bottom of the fish is the anal fin. The dorsal fin along the top of the fish acts as a stabilizer. The tail fin is the major fin for motion. Pectoral and pelvic fins are used to maneuver the fish or propel it slowly.

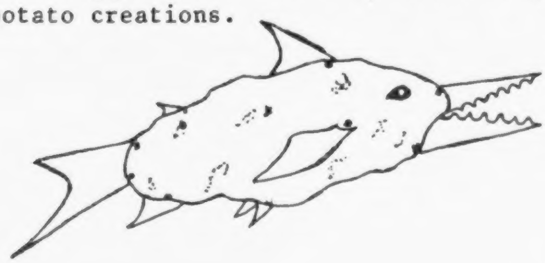
Fins, mouth, teeth and body shape are clues that define a fish's lifestyle. For example, big eyes indicate a night fish or a fish living in deep water. A fish whose mouth points downward usually feeds off the bottom. A fish whose mouth points upward feeds from the surface. Some fish have big teeth - the flounder and some sharks. Others have grinders - such as skates. And some fish have no teeth at all - such as the sea horse and pipefish. They suck their food.

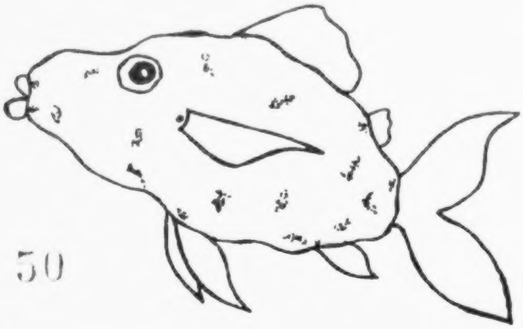
Cut patterns for fins and mouth out of construction paper or poster board. Use the potato as the fish's body. Make slices in the potato to slide in fins and mouth made of poster board. Use straight pins to add fins, mouth and eyes made of construction paper.

Some children may create realistic fish, but others may create fantasy fish.

At the completion of the activity discuss the member's fish. How does it compare to a real fish.

Suggestion - You may want to get a real whole fish to compare with the potato creations.





Activity III - Fish Casts

This activity will help members learn the parts of a fish and gain some experience in identification.

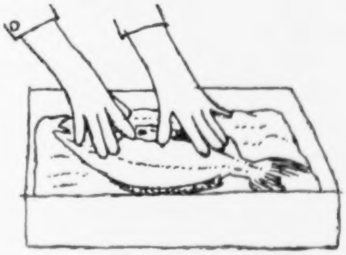
A good field guide on fishes should be used to identify each member's fish before taking the cast. This activity may be done inside or on the beach if you are fishing and using the fish caught for your casts.

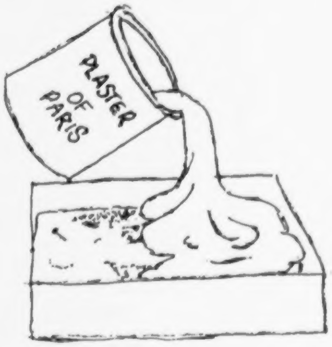
Materials Needed:

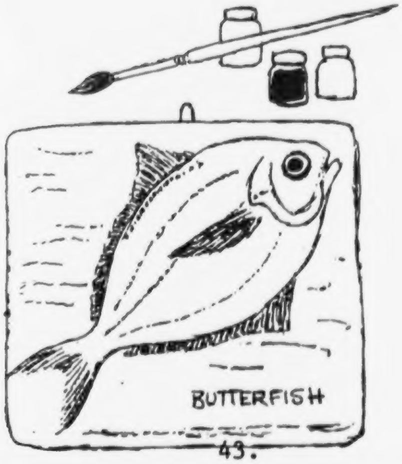
- flat board
- paintbrush
- sand or clay
- olive oil or thin lubricating oil
- long, headless pins
- plaster of paris
- large plastic dishpan
- bar of white laundry soap
- small jar of vaseline
- wire screening
- burlap or cheesecloth
- shellac

HERE'S WHAT TO DO: You can make your plaster casts right at the fishing area. Doing it on the scene will help you in the identification of the fish.

STEP 1 Choose a fresh fish. Remove slime and dirt by rubbing with salt. Rinse in cold water. Make a sand bed or one of clay. Embed the fish in the sand or clay so that one side is covered up to the back fins and the midline of the belly.







Spread the fins and pin them to the sand or clay with long headless pins. Make sure the fin on the fish's side and the gill cover are pinned flat to the body. Brush the fish with olive or lubricating oil. The oil will prevent the plaster from sticking to the fish. For the first few casts, the fin below and just in back of the head should also be pinned back against the body. Mix enough plaster of paris in your dishpan to cover the fish with a 1/2-to 1-inch layer of plaster. (For a 5-lb. fish you will need about 10 to 15-lbs of plaster of paris.)

To make the plaster of paris batter, mix the dry plaster with enough water to make a thick cream. Add the water in small amounts but work fast. The chemical action of plaster of paris and water is very swift and the plaster will set quickly. Have all your materials on hand and ready before you start.

STEP 2 Pour plaster over the fish so that it is evenly covered all over. (A 10 to 20" fish requires a coating 1-inch thick.) Allow the plaster to set for 10 to 15 minutes. Wait until the casting is hard before removing. Lift the mold, turn it over and carefully remove the fish. If you have done the job well, you will have a perfect negative cast showing all the scale markings.

Note: Clean up your plastic dishpan - the hardened plaster is more difficult to remove from metal or enamel pans than from plastic.

STEP 3 To construct the model, soap the mold thoroughly with the soap and vaseline solution using a stiff paintbrush. The solution is made by shaving a quarter of a bar of white laundry soap into a cup and covering with water. Allow the mixture to sit overnight. It will then have a jelly-like consistency that can be mixed with the small jar of vaseline.

STEP 4 Cut the exact shapes of fins and tail from the wire screening, but add to the shapes a base that can be extended into the body portions of the fish. The screen will reinforce these delicate parts of the fish model that otherwise might easily crack off. Now cover the entire surface of the mold with at least 1/2 inch of plaster of paris. Press cut screen into the matching parts of the cast. Burlap or cheesecloth can be pressed into the soft plaster on the back of the cast to strengthen it. After 2 to 4 hours, depending upon the size of the model, remove the cast by lifting the edges slightly at several points until it is freed from the form. If it sticks, tap lightly around the edges of the plaster form until it cracks and releases the cast. To protect the model, cover it with light shellac when it is completely dry. Plaster casts can be painted if you like, for a more realistic reproduction of the fish.

Mount the casts on heavy cardboard or plywood with a good glue. Label each fish, telling the kind, where it was caught, and the bait or lure used. Exhibit your casts at a club meeting.

Activity IV - Nature Prints

Many natural items found on the beach and in the water may be used for printing. For these projects use water soluble printing ink. It comes in various colors and can be found in craft shops.

Most nature prints can be done on paper or fabric.

Plant Printing

Materials Needed:

- printing ink
- styrofoam tray (like those under meat in the grocery store)
- brayer or roller
- paper or fabric

Smear print over the inside bottom of the styrofoam plate. A thin even layer is all that is necessary.

Lay the specimen in the ink. Be sure all parts of the specimen are contacting the ink. Press lightly with your fingertips. Carefully pick up the inked specimen. Place it on the area to be printed. Place a clean paper towel over the specimen. Roll with a clean brayer (roller). Apply slight pressure. Carefully pick up the specimen. The print is made.

Fish Prints - Gyotaku (pronounced ghio-ta'-koo)

The technique of fish printing has been used in Japan for over 100 years to record prize catches and gain ichthyological (fish biology) information.

This activity is an excellent way for 4-H'ers to gain an appreciation of the beauty of marine organisms. It is also an opportunity to learn more about species and anatomy of fish.

The technique used in fish printing can also be applied to printing other marine creatures such as crabs, shellfish and seaweed.

Materials Needed:

- newspaper
- modeling clay
- pins
- water soluble printing ink or tempera paint
- various size brushes
- paper towels
- fresh or frozen fish
- newsprint, moisture tolerant paper or rice paper (rice paper is expensive, you might want to use newsprint for beginners.)

Before beginning your print have your 4-H members identify their fish. A field guide of fishes will be helpful. Using the activity sheet entitled "Parts of a Fish", familiarize members with fish anatomy.

Some basic information:

Fins - Most fish have fins but they are placed differently on different species. The front part of the dorsal, anal and pelvic fins may have spines. Be careful not to let them stick you. The caudal or tail fin drives the fish forward while the others assist in turning, stopping or moving backward.

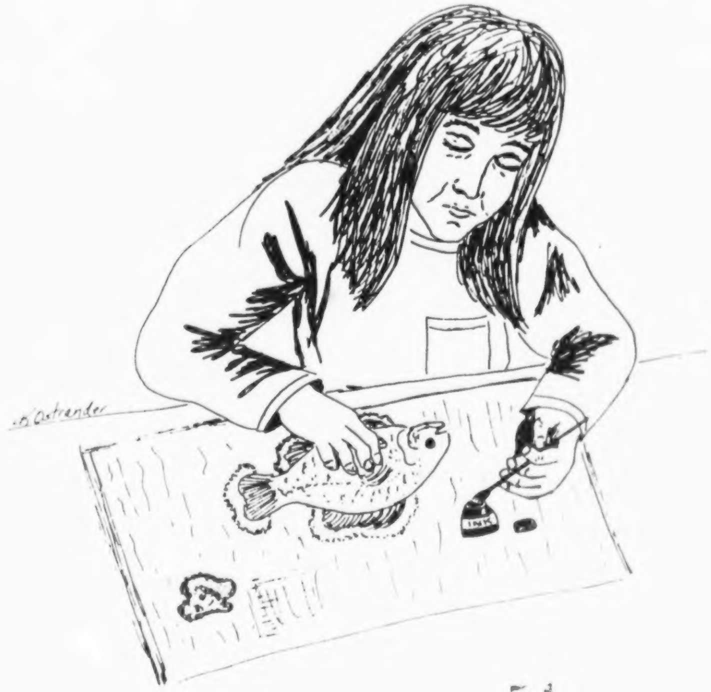
Scales - Most fish have scales but there are different types of scales. Some fish have large rough scales (bass, perch, rockfish) while others have smaller, smooth scales (flounder, trout). Shad, alewife and other herring like fishes have large, delicate scales that are easily lost and difficult to print. The scales and mucus covering of the fish help protect the skin.

Lateral Line - This consists of a line of small pores which contain pressure sensitive nerves. The lateral line enables fish to detect changes in water turbulence or movement near them. Not all fish have a lateral line.

For printing it's best to choose a flat fish such as a flounder, bluegill or rockfish. But any fish will do, fresh or frozen. Fish should be whole, neither gutted nor scaled. (You can reuse the fish for printing by freezing.) First, wash the fish with soap and water to remove body slime. Dry with a paper towel.

Lay the fish on an old newspaper and extend its fins. (To extend the fins, you may need to prop them against a ball of clay and insert pins.) Brush a thin coat of paint or ink on the top of the fish, avoiding the eye if possible. If the paint smears onto the newspaper, slide a clean piece of paper under the fish before printing.

Gently drop a sheet of blank newsprint over the fish. Press evenly and lightly over the entire body. Peel off paper without blurring the print. Add the eye dot later.



Sun Print

4-H'ers can produce silhouettes of shells, plants, crabs or other marine organisms.

Materials Needed:

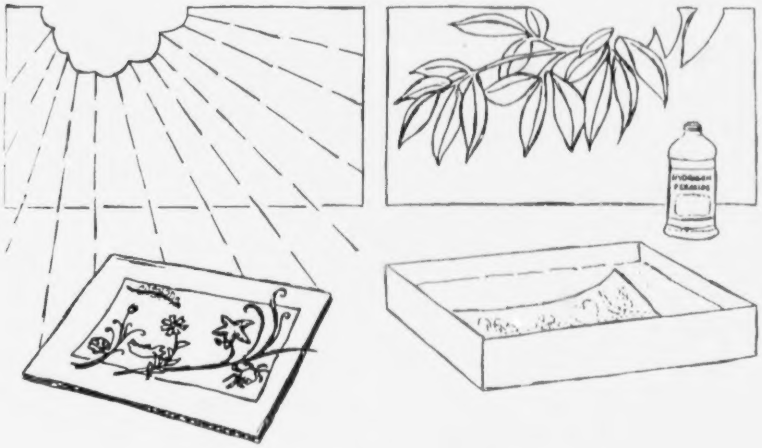
Blueprint paper (blueline ammonia paper) obtained from office supply stores or biological supply houses (store in light-proof envelopes), one or two trays large enough to hold a sheet of blueprint paper, a piece of cardboard as large as the blueprint paper, a bottle of hydrogen peroxide.

Collect specimens that are flat. Or cut out your own patterns.

Working outdoors in the shade, fill trays half full with water and add a few drops of hydrogen peroxide.

Decide how the specimens will be arranged on the paper. While still in the shade, slide the blueprint paper out of the envelope and onto the cardboard, yellow side up. Quickly arrange objects on the paper, then expose it to direct sun until the paper turns white. Return the paper to the shade.

Remove the specimens. Slide the exposed blueprint paper into the tray of water and hydrogen peroxide. Jiggle the paper in the water for about one minute or until an image begins to appear. Remove the blueprint paper and let it dry.



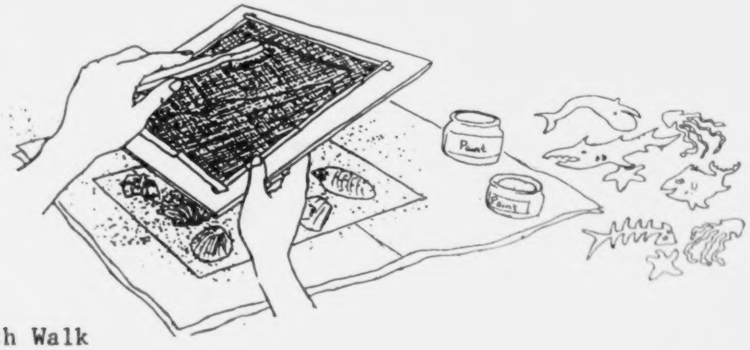
Screen Printing

This activity will help members focus on shapes in the marine and coastal environment.

Materials Needed:

An 8-inch by 8-inch sheet of mosquito screen stapled on a cardboard frame, old toothbrushes, tempera paints, construction paper.

Arrange objects or patterns on the construction paper. Dip the toothbrush into the paint. Hold the screen over the construction paper, and rub the toothbrush over the screen to achieve a splatter effect. For variation, use more than one color to splatter.



Activity V - Beach Walk

Discussing organisms at the beach is an excellent opportunity to schedule a field trip to the beach. Using the guidelines provided in this project, if possible plan a trip to a local beach.

If your club has established a salt water aquarium, now is an excellent time to collect some organisms.

When on the beach, have 4-H members think about what they already know about marine organisms. Use that information to help them locate marine organisms. Have members start a simple notebook to keep a record of what they find and where they find it.

K Ostrander

Additional Resources and Ideas

Activities from this section may also be used with the section on freshwater organisms.

The projects made in this section are excellent entries for displays. They can be easily combined with the backdrop of a beach zonation or habitat mural for an outstanding 4-H club exhibit.

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COLLECTING ORGANISMS

Introduction

Observing marine organisms is an excellent learning experience and exciting activity for 4-H marine science club members. Specimens can be collected in a variety of areas including the beach, bays and estuaries for saltwater and lakes, ponds and streams in freshwater.

In this lesson, 4-H members will learn how to collect specimens.

What Your 4-H Members Will Learn

- methods of collecting
- storing specimens
- types of organisms to be found in saltwater and freshwater areas

Background Information

Marine - saltwater
Aquatic - freshwater

Some of the best methods for collecting marine and aquatic organisms is by using a seine, cast net, or hand net. These methods usually do not harm the animals.

After you have gathered your specimens, they can be stored in a bucket of water taken from the collecting area or in small plastic bags filled with water from the area. Usually you can take these animals home for study, keep them in the refrigerator for several days and then return them to their natural habitat. A better situation would be to have an already established aquarium to put organisms in for observation.

Depending on the types of organisms you want to collect, there are various locations ideal for sampling. Below are some areas with samples of the types of organisms to be found.

Marine Organisms - Some excellent places for collecting saltwater specimens for observation are the inlets along the beach and bay. These areas are somewhat protected and marine life abounds. When you are collecting only take what can be used to learn about the species whether for the clubs aquarium or individual study. Organisms found in these areas include various crabs, oysters, clams, snails, starfish, worms, jellyfish and various small fish. Most of these organisms can be found in the intertidal zone or in shallow waters.

Aquatic Organisms - Ponds, the edges of lakes, streams and creeks are excellent places to find samples of freshwater organisms. The littoral zone of ponds and lakes extends from the waters edge outward as far as rooted plants grow. This area is the richest in the freshwater habitat and contains the greatest number of organisms. Some organisms found in freshwater include worms, crayfish, clams, snails, frogs, turtles and fish.

Preparing For The Meeting

To prepare for this activity, read the information included carefully. You may want to review some other lessons on habitats and organisms.

A necessity in collecting and identifying marine and aquatic plants and animals is a field guide. The varieties of organisms found in these areas are too numerous to cover but your members will need to see some pictures to recognize these organisms.

Two activity sheets have been included to help your members understand what organisms are in each area but a field guide is recommended. Two options:

Reid, Geo. K. **Pond Life A Guide To Common Plants and Animals of North American Ponds and Lakes** Golden Nature Guide Golden Press 1967.

Miner, Roy Waldo. **A Field Guide To Seashore Life**. New York: G. P. Putnam's Sons. 1950.

There are many other field guides from which to choose. Check your library or bookstore.

Activities for making collecting gear are included in this section. You may choose one of these activities or purchase collecting gear. You may want to have two meetings - one to select or make sampling gear and one field trip to do collecting.

Involving The 4-H Members

Group Discussion - collecting specimens generate many questions. Discuss them as they come up. The field guide will help you.

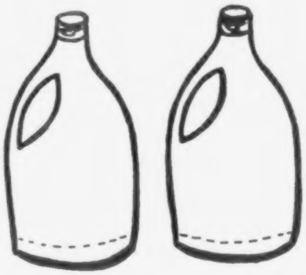
Activity I - Making Collecting Equipment

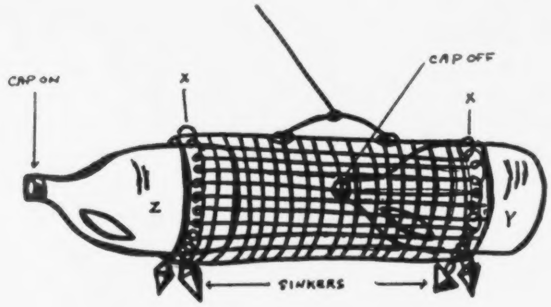
The purpose of this activity is to have 4-H members make inexpensive devices for collecting freshwater or marine specimens.

Specimen Collector

Materials Needed:

2 plastic bleach bottles
1 square hardware cloth
2 lengths of flexible wire
1 length of strong cord
4 pyramid sinkers (Fishing type 3 oz/4 oz)





Instructions for Assembly

Cut the bottoms out of each container.

Perforate the plastic container with a hot wire or ice pick in a line completely around each container at 1" intervals. (X)

Roll hardware cloth into a cylinder around the plastic containers and sew the hardware cloth to each bottle section through the cloth and the perforations with the flexible wire. The hardware cloth may be "sewn" as a cylinder before or after attaching container sections.

At the bottom of the collector, attach 2 pyramid sinkers to the perforated sections on each end of the net.

Attach the heavy cord onto the center of the hardware cloth with about 4" inbetween the two knots. Attach a single long cord to the loop for hauling in your collector.

To bait your collector use bread, dog food, food pellets or other foods. Drop the bait through the open end of (Y.) To remove trapped organisms remove the cap from (Z) and pour out the contents.

Activity II - Building a Sieve

The purpose of this activity is to help 4-H members learn how to build inexpensive collecting equipment.

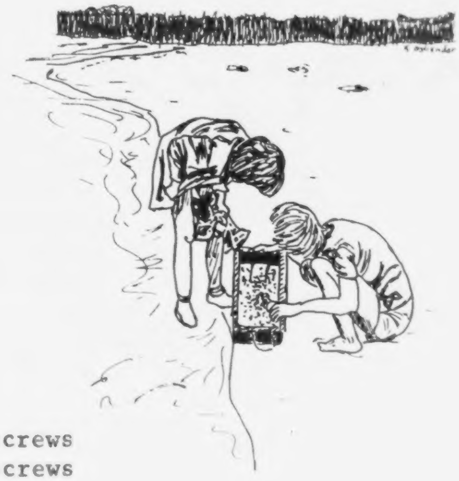
Materials Needed:

Tools
hammer or screwdriver
saw
measuring tape
drill
staple gun (optional)

1X4" pine or cedar board
2 - 10"   2 - 15"

3/4" pine or cedar stripping
2 - 10"   2 - 15"

square of hardware cloth 1/4" mesh
10 X 16
14 - 1 1/4" galvanized nails or wood screws
12 - 1 1/2" galvanized nails or wood screws
2' - clothesline cord



Cut pieces of wood to specified measurements. Using 1 1/2" nails or screws. Attach 10" end (1X4) pieces to 15% (1X4) side pieces. (3 nails in each side of each end.) This forms an oblong box.

Attach hardware cloth to bottom of the wooden square. (Staples may be used to secure hardware cloth.)

Using the 1 1/4" nails or screws attach 3/4" stripping to bottom covering the edges of the hardware cloth. Drill 2 holes 4" apart in the center of the end pieces of the sieve.

String the cord through the holes and knot on the inside to form handles.

To use the sieve, shovel sand into sieve using natural water. Rinse sand, leaving organisms exposed for collecting.

Additional Resources and Ideas

Check net companies, biology supply houses or your library for other resources on building collecting gear. Once your members have completed their projects, go on a trip to a local pond, lake or the beach or bay to try them out.

References

Freshwater and Marine Specimen Collector worksheet by Richard C. Cole.
Reid, George K. **Pond Life, A Guide To Common Plants and Animals of North American Ponds and Lakes**. Golden Nature Guide. Golden Press. 1967.
Small Oceans **A Leaders Guide to the Art of Setting Up, Maintaining and Observing Sealife in a Marine Aquarium**. University of Massachusetts. Cooperative Extension Service. 1977.
Crenshaw, Neil. **Starting and Maintaining a Marine Aquarium**. University of Florida. Cooperative Extension Service. 1980.

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WHO EATS WHOM? LEARNING ABOUT FOOD CHAINS

Introduction

Energy provided by the food eaten is an essential element to all living organisms. Every organism in the marine world is either a producer, consumer or a decomposer. This cycle is what keeps life going. In this lesson 4-H'ers are introduced to the concept of a food chain.

What Your 4-H Members Will Learn

- how various organisms fit into a food chain
- the concept of a food chain and its importance in the marine environment

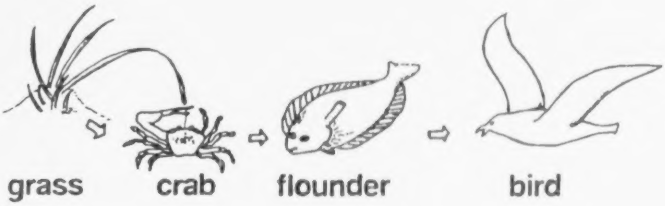
Background Information

Decomposers - bacteria, fungi, agents of decay
Producer - green plants and algae
Consumer - insect, fish, crabs, birds, any organism consuming food
Carnivores - meat eating animals
Herbivores - plant eating animals

All food can be traced back to green plants. It is only the green plants that can capture energy from the sun and, together with water, air and soil, change it into the chemical energy of food. The green plants produce the foods that keep the ecosystem running; no other form of life can do this.

All other living things depend directly or indirectly on plants for food except in vents in oceanic rifts. You can picture this as a sequence of "who-eats-whom" or a chain within an ecosystem. Everyone in nature seems to be food for some other creature. Plant eaters, or herbivores, eat plants. A herbivore is a first order consumer. They then are eaten by meat eaters (carnivores) which, in turn, are second order consumers. Carnivores are eaten by other carnivores. A carnivore who eats another carnivore is a third order consumer. These carnivores are eaten by still other carnivores. In this way we get a food, or energy, chain that may have four or five links.

A four-link chain may occur if grass is eaten by a fiddler crab, a fish flounder eats the crab and a wading bird eats the founder. If the wading bird were eaten by an alligator, the chain would extend to five links.



All food chains end when the dead organisms or the waste products of living things are eaten by fungi, bacteria and other agents of decay. These are the decomposers, they are actually at work at every level. They use the last energy left in the materials and break them back down to their basic elements. These basic elements, carbon and nitrogen, are returned to the air, soil and water and used by the green plants to begin the cycle again. All food chains begin and end with water, soil and air, so all complete food chains begin and end with the basic elements that are used over and over again.

Plants are usually eaten by more than one kind of animal. A herbivore often eats more than one kind of plant, and a carnivore usually eats more than one kind of animal. This more complicated pattern of "who-eats-whom" is a food web. A food web is a combination of two or more food chains that share some of the same plants and animals.

Preparing For The Meeting

Read the background information to familiarize yourself with food chains. Read over the activity below and gather all necessary materials.

Involving The Members

1. Discuss the sample food chain.

2. Which animals are the first order consumers? Second order consumers?

3. Where do people fit into the food chain?

4. Why can we say that evergreen plants are not independent organisms?

Activity - Food Chain Game

The purpose of this activity is to understand the relationship between predator and prey and to understand nutrient recycling in the natural environment.

Materials Needed:

. 1 paper bag per person
. 1 set of identification cards
. 1 large bag of popcorn
. large open room or field

Preparation:

- select a short food chain to use in the activity (e.g., algae - insect-fish-decompose/nutrients)
- label a set of 3x5 cards for 12 members as follows:

16 - algae
5 - insect
2 - fish
2 - decompose/nutrients

- review terms that describe the organisms

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producer - algae
consumer - insects, fish
predator - fish
prey - insect
decompose - releases nutrients

- Explain that each person will play the part of an organism in the food chain. The paper bag represents the organism's stomach, and the popcorn represents the "energy" supply of each organism.

- Briefly describe the food chain. A simple poster like the one in the background information may help here. The insect eats algae; fish eats insect; fish dies, decomposes, and releases nutrients; algae absorbs nutrients. Emphasize the process of energy transfer and assimilation.

Procedure:

- Give each child a bag and a small amount of popcorn placed in the bag.
- Place the ID cards in a bag, mix them thoroughly, and allow each member to draw one. 4-H members should keep their identity secret.
- Instruct members that they are to move around quietly within the assigned area (just as animals move around in the wild). Here the children may imitate the animals: floating algae, crawling insects, swimming fish, sneaky death and decay.
- On a signal (whistle, call, etc.) members pair up at random. They examine each others ID cards. The individuals to be eaten, pour their popcorn and card into the others' bags, then return to get another ID card and more popcorn and re-enter the game.

Examples:

- algae and insect pair up, insect eats algae
- fish and insect pair up, fish eats insects
- algae and decompose pair up, algae absorbs nutrients
- decompose and fish or insect pair up, decompose consumes fish or insect
- like organisms pair up - nothing happens, continue in the game

- Continue the game for 10-15 minutes or until all ID cards are used.
- Gather members together and discuss their success in the food chain.

Ask questions like:

- Why were there so many algae?
- How does man affect a food chain?
- Why is decomposition important?

- During the discussion, members may share and eat their popcorn.

Follow-up:

- Have 4-H'ers research different types of food chains (terrestrial, aquatic, marine, etc.)
- Using drawings and pictures from magazines, make posters or mobiles illustrating different food chains.

Additional Resources and Ideas

Using pictures from magazines mounted on cardboard, have members make food chain mobiles. Check the section on shell collecting for instructions on making the mobile.

References

Lein, Violetta. Investigating The Marine Environment and Its Resources, Texas A & M University. 1979.

MOLLUSKS - TREASURES OF THE SEA

Introduction

Any marine experience is incomplete without discussing shells. Shell collecting is a popular hobby. Collectors swap shells with each other. Some collectors sell their collections to museums. Others operate shell shops or may sell their shells to shops.

In this lesson, 4-H'ers will learn about common shells of New Jersey and some methods for collecting.

What Your 4-H Members Will Learn

. the basic parts and purpose of a shell
. where shells can be found
. how shells can be collected

Background Information

Mollusca - the zoological category containing soft bodied, shell bearing invertebrates. Mollusk refers to any member of that group.
Bivalve - a mollusk with a shell consisting of two hinged parts
Univalve - a mollusk with a single shell
Gastropods - mollusk having a single shell and muscular foot
Operculum - foot like structure on gastropods which closes off the shell opening
Radulae - teeth in mollusks
Concave - curved inward
Convex - curved outward
Whorls - step like structure around the top of univalves
Apex - the top point where whorls originate
Aperture - the opening on a univalve
Lip - thin outer edge of a univalve
Columella - thick inside edge of univalve shell

A seashell is one of the 100,000 backboneless animals belonging to the zoological group known as Mollusca. Mollusks also include squid, octopus and chambered Nautilus.

True molluscan shells come in two varieties - bivalve and univalve. Bivalves having two shelly valves, fitting together along a toothed hinge on one side and kept closed by adductor muscles. Univalves have only one shell usually coiled, but sometimes shaped like a cap or in a conical shape. Some marine univalves can seal themselves inside with an operculum, which covers the open end of a shell like a trap door.

Although shells have many varied shapes, the creatures inside are all pretty much alike. Each has a foot, a breathing siphon, a tiny brain, a heart and a mantle which secretes lime for shell building. Most true mollusks have eyes, but a few are blind. Many have teeth called radulae.

A true mollusk moves around the ocean floor on its foot and a little by swimming. The shell on the mollusk is its form of protection and it lives its entire life inside the shell. It lays millions of eggs and hatches countless baby shells.

The two parts of a bivalve shell are like thin saucers concave on the inside, convex on the outside. The inside is smooth, the outside rough with ridges. The univalve is conical and spiraling, with a series of whorls coming down like widening steps, coming down from the tiny nucleus on top called the apex. Sometimes univalves have spikes around the largest whorl. The opening called the aperture, has a delicate righthand rim called the lip and a heavy lefthand edge called the columella.

Looking for shells is not always easy. Many mollusks are food for larger organism so hiding is one of their specialities. Many people collect dead shells that have washed up on the beach. To build a good collection you should take shells alive, then clean and prepare them yourself. But you will not find live ones unless you go where they live.

Preparing For The Meeting

There are many species of mollusks. To prepare for this meeting, you will want to get a shell guide from the library or book store. It is a good idea to have members bring shells that they have collected to this meeting. You can use their shells to show bivalve and univalve differences.

Read over the background information carefully. It contains a lot of shell terms. Using the worksheet entitled "Mollusks" in Appendix I, instruct 4-H'ers to fill in the parts of shells on their copy while you explain each part. There are several activities included relating to shells.

You may want to choose an activity or project to make using shells found on the beach or begin live shell collecting. Mollusks are great additions to an aquarium also.

Involving The 4-H Members

Discuss mollusks. Compare the shells found on the beach with live mollusks. Have 4-H members share stories about shell collecting. Discuss where mollusks are found. Which zone of the beach is best for finding shells?

Activity I - Shell Critters

This activity is very simple and can be done with dried shells collected along the beach or bay.

Materials Needed:

To make shell critters all you need is shells, glue, a black marking pen and a good imagination.

Glue shells together to make interesting critters. Add the eyes on the finished creature with a black marking pen.

Activity II - Shell Mobile

This project is a little more difficult but can also be made from local dried shells.

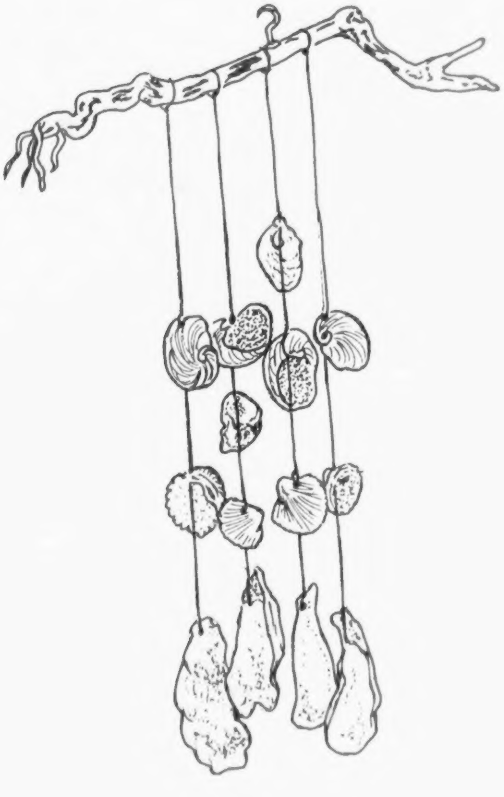
Materials Needed:

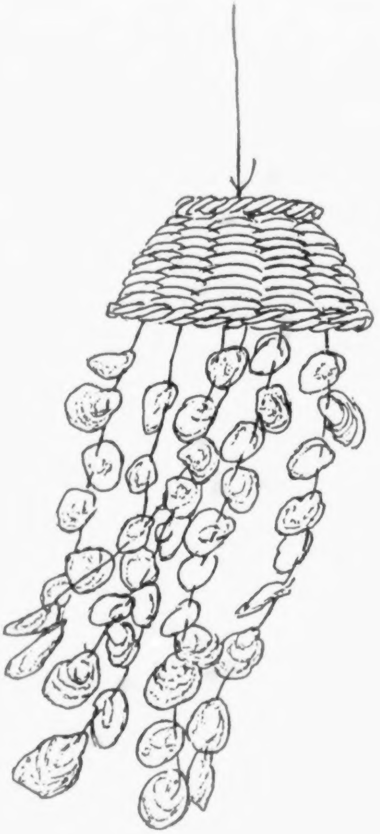
A piece of driftwood or a 10-inch by 1-inch strip of wood, 10 to 20 shells for each mobile, one cup hook, fishing line, scissors, quick setting glue, small loops of ribbon if an electric drill for making holes in the shells is not available. (The drill works well if used carefully. Otherwise, the shells will break.)

Cut four 24-inch pieces of fishing line. Either glue ribbon loops to shells and allow the glue to dry or drill holes in the shells near the hinge. Slide the first shell onto the line and position it about 4-inches from the top. Tie it to the fishing line using an overhead knot. Tie the remaining four shells about 2-inches apart. Repeat the procedure for the other three lines.

Tie the four lines to the wood, placing them 2-inches apart and 1-inch from each end of the wood. Remember the mobile should balance. Attach the cup hook to the top of the wood so that it balances the four lines. Hang.

A variation of this project may be done by using a small basket instead of driftwood and attaching the strings of shells around the outside edge of the upside down basket. Attach a string to hang the wind chimes by, on the center bottom of the basket.





Activity III - Shell Collecting

Any beachcombing experience is incomplete without collecting shells. The amount and variety of shells found on our beaches varies with the changes in the sea and shore. Collecting techniques also vary dependent on the shoreline. On sandy and muddy shores digging, dredging and seining are the main collecting methods. You have got to be a detective. These little creatures living in the shells are the natural food for many larger creatures so one of their greatest talents is hiding.

After collecting, shells can be cleaned by boiling, freezing, soaking in alcohol or diluted laundry bleach, or by hanging in the sun to dry. Apply glycerin or mineral oil to hinges of bivalves to keep them flexible. Your collection may be displayed in wood or cardboard boxes with separate compartments, in egg cartons, or glued to display boards. Label your display with names of the shells, dates and locations of collection and the collection name.

You may want to number your shells and keep a corresponding card file containing a card for each shell in your collection. Include the information listed above on each card.

While collecting shells along the fore beach and intertidal area, carry a notebook to make notes on shells that you find. Record the place, date and time of your findings. Identify your shells and record by name when possible. Sketching and descriptions of specimens may be helpful in later identification. Number your shells to correspond with descriptions and identification.

An activity sheet entitled "Common Shells of New Jersey" is included in Appendix I in the back of this book to make identification easier.

Additional Resources and Ideas

There are many shell books in your local library. Books on beachcombing and arts and crafts also include shell projects.

Completed shell projects and displays are excellent entries for county fairs, shows and exhibits.

References

"Let's Collect Rocks and Shells". Shell Oil Co.
Aprill, Glenn. - **"Common Seashells of Delaware"**, University of Delaware. Delaware Marine Advisory Service Publication. Sea Grant College Program.
Kohn, Bernice. **The Beachcombers Book**. New York: The Viking Press, 1970.

ESTABLISHING A SALTWATER AQUARIUM

Introduction

Establishing and observing a saltwater aquarium is an excellent hands on experience for 4-H marine science club members of any age. It is a multi-faceted learning experience in that it provides opportunities for studying both habitats and organisms. In this lesson you as a 4-H leader will gain information on working with your 4-H club members in establishing an aquarium.

What Your 4-H Members Will Learn

- . the equipment necessary for establishing an aquarium
- . steps in setting up a saltwater aquarium
- . information about oxygen, salinity and temperature
- . marine habitat information
- . how to collect marine organisms
- . the identification and behavior of marine organisms

Background Information

Review the section on the aquarium as a habitat. This will provide a good background for setting up a saltwater aquarium.

Preparing For The Meeting

To prepare for this section secure a copy of **"Small Oceans, A Leader's Guide to Setting Up, Maintaining and Observing Sealife in a Marine Aquarium"** from your county 4-H office. This booklet provides a complete overview of this topic. Read it over and follow it carefully. A trip to a pet shop or some other facility with aquaria on display is an excellent preliminary to beginning this project. This project will cost some money so it's a good idea to establish your club treasury before beginning. Your trip to the pet shop would be an excellent opportunity to estimate costs.

A location for your aquarium may be a problem. Talk to your 4-H agent, perhaps it can be established in the Cooperative Extension Office or 4-H Center as a display.

Involving The 4-H Members

Completely discuss the steps involved and the responsibility of keeping an aquarium with your members before you begin. As the materials and organisms are gathered, numerous questions for discussions will emerge. If the answers are not readily available, various members may want to research the answers.

It is very important to get the 4-H members actively involved in setting up the aquarium. It will give them a greater understanding of the marine habitat. Your club may want to go out and collect the organisms to put into the tank. Methods and equipment for collecting is included under "Collecting Organisms".

Whether you collect or buy the organisms, it is extremely important to identify each organism and learn something about it before including it in the aquarium.

Once all equipment is gathered and information on aquariums is discussed, the best method is to just jump right in and get the aquarium going. It will be an excellent experience for your 4-H club members.

To help your members understand some of the most common problems in maintaining an aquarium, refer to the activity sheet "Protect Your Saltwater Aquarium from N.O.O.T."

Additional Resources

Pet shops and libraries have numerous books on aquaria available.

SECTION III

Career Exploration

WORK BY THE SEA

Introduction

Many people find the idea of working around water very exciting. Not everyone can be another Jacques Costeau but there are lots of jobs which relate to the sea.

In this lesson 4-H members will begin to become aware of jobs related to the marine world.

What Your 4-H Members Will Learn

to think about the marine world in terms of jobs

Background Information

Almost every career on land has one which is somewhat similar in the marine world. The range in marine careers is very broad. It runs from fisherman to trained scientists and engineers. Most of the people in marine careers work near the sea rather than on it or in it. They conduct the businesses which support activities at sea.

Preparing For The Meeting

This section is very simple and designed merely to get 4-H members to broaden their understanding of jobs related to the marine environment. Read the background information and think about everything that links to the sea, products of the sea, fishing, boats, oceanography, navigation education, science, etc., just to name a few. Collect magazines with pictures of things related to various marine careers.

Involving The 4-H Members

Discuss what we know about the world of jobs related to the marine environment.

Ask members if they know any one who has a job related to the sea or marine science. What do they do?

Ask members to think about various products from or related to the marine and coastal environment. What jobs are related to these products?

Activity I - Marine Careers Collage

Materials needed:
- newspapers and magazines with marine related pictures, etc.
- scissors
- glue
- construction paper

Have members cut out pictures of things that relate to the marine environment. Make a collage.

Additional Resources And Ideas

The library may have some additional information on marine careers.

Have a person who works in a marine related career talk about their job.

A CLOSER LOOK...MARINE CAREERS

Introduction

Today's youth are exposed to many career areas and opportunities through travel, school, and the media. Many young people are overwhelmed by sheer numbers of career choices and need guidance in pinpointing a prospective career. Finding out what you like to do and how it relates to jobs is a good beginning. In this lesson, 4-H members will look at the world of work in the marine area.

What Your 4-H Members Will Learn

. a basic understanding of the variety of marine careers
. to look at the education and activities involved in marine careers

Background Information

The mass media, by playing on society's ageless fascination with the sea and its creatures, have contributed largely to the popularity of marine-related careers. Most, if not all, of the media's treatment of marine careers, however, has focused on some aspect of marine biology, which is just one of a great many careers that pertain to the oceans. This media emphasis continues to motivate students toward careers in marine biology.

Marine careers are not limited to the study of ocean life. Often, marine-related jobs, particularly technical professions, are merely extensions of jobs performed on land. Some of the categories of marine-related careers that exist today include the merchant marine, fishing and the seafood industry, recreation and tourism, marine sciences, marine environmental management, marine technology, and the marine military. The educational requirements for these marine careers vary widely, from a high school degree to a Ph D degree, depending on the career choice. It is fair to say, however, that most careers require some type of formal education or training, and higher education usually means greater opportunities for advancement. Careers in the sciences, particularly those in the physical sciences, currently offer students some of the best professional opportunities.

If 4-H members are considering marine careers, it would be to their benefit to read as much information as they can about the careers, their requirements, and their potential job availabilities. Here is a good place to start. Suggest to your members that they contact someone who is working in the career of their interest, so that they can get some first-hand knowledge about their field.

Preparing For The Meeting

Read the information provided in the background information. Additional information is available through the library. Look over the suggestions for activities included and plan for your meeting by making the necessary arrangements. Consult the Field Trip Guide in Appendix II for further help in planning.

Involving The 4-H Members

Discuss with your 4-H members their interest in a marine related career.

What would they like to do? What do they know about the job?

Discuss the pros and cons of specific marine related jobs.

Activities

Contact a resource person with information or experience in a marine career. Have them talk with your members about their job.

Many local vocational-technical schools have programs in marine biology. Contact your local vo-tech school for ideas.

Visit a commercial fishing boat, aquaculture operation, seafood processing plant or other marine industry.

Additional Resources

The University of Delaware Sea Grant Marine Advisory Service has produced a 20 minutes slide/tape presentation entitled "Marine Careers" which is available on free loan to educators. Contact your 4-H agent and ask them to help you secure the slides. They can call (302)645-4253 or (302)451-8185 for information.

The New Jersey Marine Sciences Consortium is an excellent resource for information. Contact them at Sandy Hook (201)872-1300 or Seaville (609)390-3320.

References

Hall, Wm. R. **"Marine Related Careers"** MAS NOTE. University of Delaware Sea Grant Marine Advisory Service.

TOOLS OF THE TRADE

Introduction

The coastal and marine environment provide the resources to support a productive commercial fishing industry in New Jersey. This industry provides a livelihood for thousands of fishermen. The large variety of seafood species harvested in New Jersey require many different types of expensive fishing gear. In this lesson, your 4-H club members will become more aware of how seafood is caught and the importance of the New Jersey Commercial Fishing industry.

What Your 4-H Members Will Learn

. a greater awareness of the commercial fishing industry
. recognize various fishing methods and the species they yield

Background Information

New Jersey's proximity to the rich Mid-Atlantic fishing grounds and the numerous marine habitats such as the shallow continental shelf waters, an extensive system of productive bays and rivers and abundant wetland areas have contributed to the state's appeal for both recreational and commercial fishermen.

In the past ten years, New Jersey's landings of edible, ocean species (excluding inshore species such as blue crab, oyster and soft clam) have accounted for almost 45% of the Mid-Atlantic region's annual landings and 40% of the value of these landings. New Jersey's 1981 commercial landings of edible seafood were 85.25 million pounds with a dockside value (price to the fishermen) of $44.17 million. These landings rank New Jersey 12th nationally.

Some examples of New Jersey's commercial fishing industry include; the three major ports in New Jersey's two southern ocean fishing counties, Cape May-Wildwood, Atlantic City, and Sea Isle City, provide employment for over 900 people, service over 160 boats and have replacement values of over $75 million. Cape May-Wildwood is unchallenged as the largest port with the most diverse fishery. About 125 resident boats and many transient boats from other states contribute to its landings of over 40 different finfish species and 10 major shellfish species. Fourteen private docks compete in the packing and shipping of seafood to the three onshore processing plants and out of state markets. Several of the docks have begun to prepare product for mid-west and overseas markets.

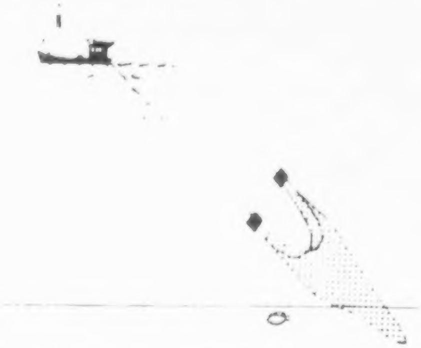
Atlantic City and Sea Isle City primarily contribute to New Jersey's rich shellfish harvest. Atlantic City with its proximity to the state's surf clam beds is a leader in this fishery. Sea Isle City, with its restricted inlets, supports about 10 smaller fishing boats engaged primarily in fishing for Lobster and Sea Bass.

The statistics on any commercial fishing industry fluctuate depending on the abundance of species, proximity to fishing grounds and state and federal restrictions on harvest. The National Marine Fisheries Service is responsible for collecting current data on the commercial fishing industry and can provide the latest statistics.

The large variety of seafood species harvested by New Jersey fishermen requires many different types of harvesting gear. This gear can be divided into three basic types of gear to capture seafood: 1) nets for fish, (on or off the bottom) 2) dredges for shellfish buried in the bottom and 3) traps for fish and shellfish species.

Trawling Gear

Most of New Jersey's ocean fishing is performed with nets, termed trawls, that are towed or dragged across the sea bed. These nets are called **otter trawls** and have large wooden boards called doors on their edges to open the mouth of the nets as they are towed through the waters.



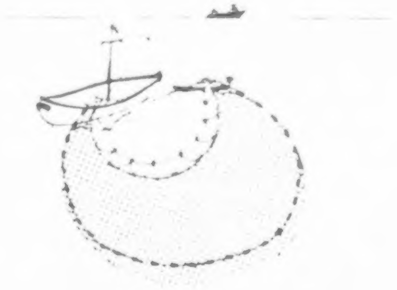
Boats in these fisheries are called draggers and range in size from small 40 foot wooden boats or to 100 foot steel hull vessels. Large vessels allow fishermen to go further offshore in their search for fish schools, to pull larger nets and to trawl faster.

Otter trawls are prohibited in most of the state's waters. They are not allowed in our bays and are only permitted in the narrow band of coastal waters from 2-3 miles off our coast.

Purse Seining

In terms of volume of fish landed, menhaden or bunker are New Jersey's most important species. These fish move inshore in the summer and are harvested with large purse seines. Fishermen use spotter planes to locate schools of fish and then use their seines to circle these schools. As the net is closed around them the menhaden rise to the surface and food fish such as bluefish or weakfish dive for the bottom. Only the menhaden are caught in the net as the bottom of the net is pursed or closed. Finally the fish are dipped or pumped out of the bag formed by the net.

Because of the selective nature of this fishery there are very few restrictions on these nets for menhaden in New Jersey waters. These nets have been modified so that they can be used to catch large volumes of tuna fish.

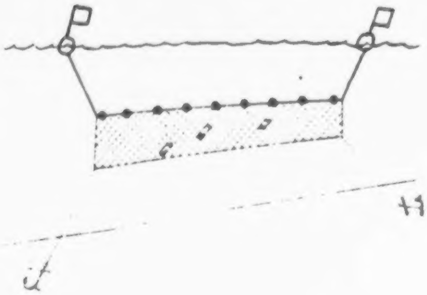


Gill Nets

Gill nets are a passive form of fishing. When hanging in the water these nets form a barrier that is either anchored or drifted. Fish swim into this barrier and then try to back out. When backing out, they catch their gill covers and are caught in the net.

In New Jersey, gill netting is performed by fishermen in small boats or garveys of about 16 foot to 24 foot. Fishermen are allowed to use gill nets in Delaware Bay and the state's coastal waters but are not allowed in other bays or sounds.

Some examples of species caught by these methods include; weakfish, bluefish, menhaden, flounder, swordfish, tuna, tilefish and squid.



Shellfish species are some of the most important fisheries New Jersey. Total landings of species such as surf clams and ocean quahogs exceed landings of all finfish species except menhaden. Other shellfish such as oysters and clams are traditional favorites in New Jersey.

Different types of dredges are used to take shellfish from the bottom. Oyster dredges have been used for over one hundred years in Delaware Bay oyster grounds.

Sea Clam Dredge

Sea Clams can be harvested by digging them out of the sea bottom. Dredges have been developed that use jets of water to pump the clams out of the bottom. These large dredges are some of the largest in the New Jersey fleet and may have openings of 20 feet.

Sea Clams, found from the beach surf zone to about 30 miles offshore, support a major processing industry in South Jersey. This important resource is made into fried clam strips, canned minced clams or used in clam chowders.

In 1976, State and Federal Agencies were concerned that sea clammers were over fishing the Atlantic Sea Clam beds. Resource studies showed that abundance of the clams had declined sharply and protection was needed to maintain the stocks. As a result of these studies State and Federal plans were implemented that limited the annual harvest of sea clams.

Scallop Dredge

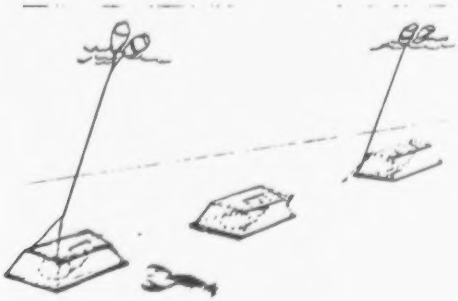
Scallops are very active bivalves and live on the surface of the sea bed. They are harvested with a dredge that requires no teeth to dig in the bottom. Two dredges are used on each vessel. These vessels travel to the scallop beds and fish for 10-14 days before returning with 40 pound bags of shucked scallops.

Other Clamming Gear

Automated clam harvesting gear is prohibited in New Jersey bays. Bay clams or hard clams caught in New Jersey are harvested with a variety of hand operated gear. The bull rake is the most common gear used by baymen in small garveys. A clam hoe may also be used in shallow waters where these boats can not operate.

Trapping Method

Many important commercial species may be caught in traps. Examples of these fisheries are crab traps baited with menhaden, unbaited sea bass and lobster pots baited with fish scrap.



Preparing For The Meeting

To prepare for your club meeting read the background information carefully. There are additional resources available through the library if you want more information.

In Appendix I a worksheet entitled, "Tools of the Trade" has been included to compare types of fishing gear and to also be used in the Fisheries game included below.

Involving The 4-H Members

Discuss what we know about the commercial fishing industry. What kinds of jobs are related to this industry?

Ask members if they know anyone who is a commercial fisherman. What do they do?

ACTIVITY I Fisheries Concentration

Begin by making two copies of each of the "Tools of The Trade" worksheets included in Appendix I. (Makes 1 game)

. Have members cut the sheets apart to make individual cards
. Using construction paper mount each card. The name of each species and the type of gear is printed on the card
. After the cards are completed members may play the game

How to Play:

Shuffle the cards and place them facedown on the table. Two members take turns flipping over the cards, two at a time. If the cards do not match, they should be replaced facedown. The object of the game is to match the species with the method used to catch it.

When a member makes a match he/she gets another turn. The winner is the person with the greatest number of matching sets after all cards are faceup.

Matches include:

Striped Bass	Hook & Line, Fish Trawler or Gill Net
Weakfish	Hook & Line, Fish Trawler or Gill Net
Crab	Atlantic Hard Crab Pot
Scallop	Bar Dredge
Squid	Fish Trawler
Flounder	Hook & Line, Gill Net, Fish Trawler
Clam	Rake
Lobster	Atlantic Lobster Pot

ACTIVITY II Special Programs

Visit a commercial fishing boat or visit the dock to gain a better understanding of types of fishing gear.

Contact a resource person with information and/or experience in commercial fishing to speak to your group.

Additional Resources and Ideas

Additional activities for this section may be found under the heading "More Marine Activities" in this booklet. "Making a Net" or "Knot Tying" can be used.

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SECTION IV

Community Involvement

SHARING 4-H MARINE SCIENCE PROJECTS

Introduction

Learning to share ideas is an important part of your 4-H members' development and an important part of the total 4-H experience. This section will help you to guide your members in sharing their ideas and creating a greater awareness of the 4-H marine science project.

What Your 4-H Members Will Learn

- ideas for sharing their knowledge of marine related topics with others
- how to create interest in the 4-H marine science project

Background Information

When youth join 4-H they have an opportunity to become involved in many new fun and learning activities. They have a chance to develop skills and gain knowledge related to a subject as well as to themselves.

Sharing their knowledge is an important aspect of 4-H involvement for 4-H members.

Through public speaking, club displays, exhibits and community activities, 4-H members also gain confidence and enhance their personal development by putting their knowledge and skills to work.

Preparing For Your Meeting

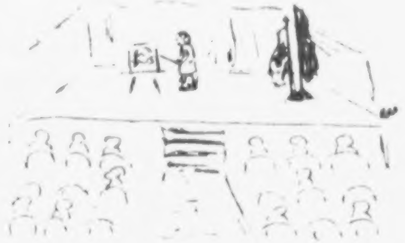
In helping your members share their knowledge and skills it is necessary to do some background work. The first step is to check out your community and county for opportunities to tell the 4-H marine science story. Look for events held by your own county 4-H program, 4-H Fair, Expo, Public Presentations, etc., as well as other events (i.e. Festivals, Fairs, etc.) in which to participate. Check with your county 4-H staff for additional help.

Involving Your 4-H Members

There are a variety of ways for members to share their knowledge and skill in marine science.

Public Presentations:

Participate in the county 4-H public presentations day. Some ideas for presentations relating to Marine Science include:



1. The strange ways of laying eggs, as illustrated in the whelk, skate, moon shell, sea horse.
2. The unusual habits of the hermit crab.
3. The story of wampum, Indian money, from the quahog or hard shell clam and the whelk.

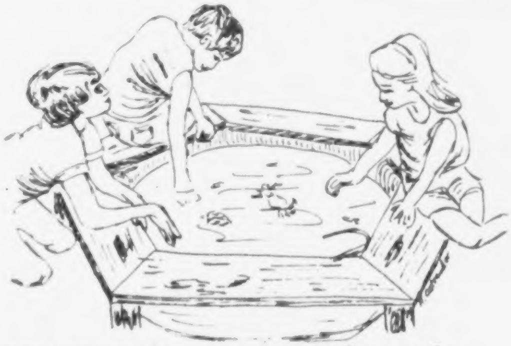
4. Scallops, how they swim by jet propulsion, other characteristics.
5. Oyster farming-their enemy, the starfish, the myth of the "R" month.
6. Sea Shells, strange skeletons of mollusks, lime from the sea.
7. Sea weeds, are they algae? Are they of value?
8. Useful products from the sea.
9. The erosion of our shorelines.
10. Tides - what causes them?
11. Why is the sea salty?
12. Sandpipers and other shore birds, their adaptations.
13. Pearls and how they are formed.
14. Sea anemones - plants or animals?
15. Weather at the seashore - on shore and off shore breezes. Which cools off faster, land or water?
16. Salt water food chain. Clams and barnacles eat plankton. Starfish, crabs, etc., eat oysters, clams. Invertebrates prey on each other. Vertebrates prey on smaller vertebrates and invertebrates.
17. Various ways of mounting sea shells.

Action Exhibits

Action Exhibits provide an opportunity for 4-H club members to work together on a presentation.

The basic idea is that club members working in groups present one topic from beginning to end with each member of the group covering a different aspect of the same topic.

For example:
Shells
1st member "Mollusks - What are They?"
2nd member "What are Sea Shells Made of?"
3rd member "Shell Collecting"
4th member "How to Clean Shells"
5th member "Displaying your Shell Collection"



To do an action exhibit, the club sets up a complete exhibit table and actually demonstrates how to do their topic.

Some of the parts are very simple, geared to younger members and some more advanced for the more experienced.

The exhibit can include posters, props, and actual products and cover any topic. Use your imagination. The advantage of this type of demonstration is that everyone works on it together and completely covers one topic giving a wide range of information.

A. Deciding on an Exhibit Topic

1. The purpose is to sell an educational idea or message.
2. Choose one simple subject which can teach a skill or can give knowledge to the public.
3. Allow club members to choose to demonstrate one skill which they have learned.
4. Choose an exhibit which will be interesting and educational to the general public.

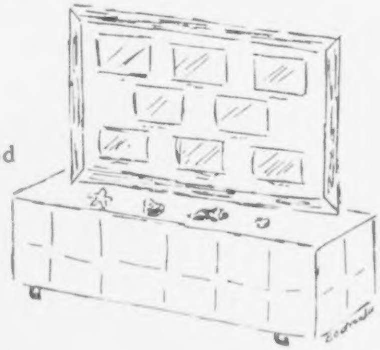
5. Choose an exhibit which will allow members to feel confident and at ease in what they are doing.
6. Choose a topic which will not require a great deal of materials to be transported.

B. Planning the Exhibit

1. Colors
    a. Choose 3 basic.
    b. Use same colors on table, poster, step signs, and tie in to exhibitors.
    c. Choose colors which will attract attention.

2. Poster or Title Sign
    a. Lettering
        . all one color
        . similar size and style
        . easy to read from 50 feet away
        . stencils are acceptable
        . make letters and attach
    b. Short, catchy title or exhibit name.
    c. Limited to one idea.
    d. Use large foam board or paint washer or refrigerator box.
    e. Club name should not dominate the exhibit.

3. Exhibit Table Arrangement
    a. Well organized and in logical order.
    b. Step signs lead the viewer - color coordinate.
    c. Use suitable table cover - vinyl is good for cooking - color coordinate.
    d. Do not clutter or overcrowd.
    e. No clutter visable under the table.
    f. Cover brand names on containers.
    g. Handouts for the public.



4. Exhibit Participants
    a. Neatly dressed, not necessarily alike.
    b. Unite with matching nametags, aprons, hats, etc.
    c. Must know why, how, and what they are doing.
    d. Should never eat or drink while at the exhibit.

C. Presenting the Exhibit

1. Participants need to be smiling and enthusiastic. Always be selling. Initiate conversation with visitors.

2. Participants demonstrate and explain with confidence.

Entering 4-H Projects

Throughout the year there are events in which 4-H members may enter their project work. Talk to your 4-H professional about including marine science divisions for entries and encourage your members to participate. There are many projects related to marine science just perfect for entry.

Additional Resources and Ideas

Your Cooperative Extension Office will have information on how to plan and prepare an exhibit or a demonstration.

You Present. Rutgers Cooperative Extension. New Brunswick, N.J.

How to Do a Demonstration. National 4-H Council

How to Give a Speech. National 4-H Council

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FACING CURRENT ISSUES AND PROBLEMS

Introduction

New Jersey is a state richly endowed with coastal and marine resources. Despite the state's small physical size, its proportion of 1,792 miles of coastline to total state area, is the 2nd highest in the nation. Almost 20% of the state is classified as coastal area but perhaps the most striking feature of New Jersey's coast is its diversity. Coastal uses include sites for the state's large petrochemical industry, housing for citizens in over 240 coastal municipalities, recreation for residents of New Jersey and neighboring states and fisheries production for important commercial markets.

With so much activity surrounding coastal and marine environments many issues and problems develop.

The future of our coastal and marine resources in New Jersey depends heavily on making wise decisions relating to coastal use and management, pollution, fishing regulations and other environmental issues. In this lesson 4-H members will become more aware of problems and issues related to marine and coastal resources.

What Your 4-H Members Will Learn

- how to look at issues related to the marine and coastal environment
- ways to recognize issues and problems
- how to get involved in helping to protect the environment

Background Information

The natural resources of land, water, air and living things are a heritage that we all share. Not only are these things nice to have in our world, they are essential to life. Many resources and living things interact to balance and perpetuate our environment. Man is only one species living in the world, but he is the most intelligent and the one capable of making decisions which effect the future of our world and it's resources. Each of us is responsible for taking care of our natural resources by making wise decisions which are in the best interest of our environment. Whether we are deciding to recycle, conserve water, not litter, attending a town meeting to voice our opinions on laws or policies effecting our resources, or obeying signs which say "Keep Off The Dunes". The choice is up to us.

Preparing For The Meeting

In preparing for this lesson, read over the background information to set the tone for the meeting. Read activities included and collect necessary materials. If your club members are interested in covering a specific problem or issue you will need to secure additional information from the library or check with your Cooperative Extension Office.

Involving The 4-H Members

Discuss current problems and issues with 4-H club members.

1. What problems and issues are evident in your community?
2. How do these problems effect us?

3. Are there city, county or state policies or laws aimed at controlling current problems - what are they?
4. What are city, county or state agencies doing to address the issues and solve community problems?
5. Are there some things that we as individuals or a club can do to help?

ACTIVITY I Issues Poster

Collect current newspapers and magazines including articles about marine and coastal issues.

Have members cut out the articles and glue them on posterboard to show current issues.

These posters can be used in a display to increase public awareness.

ACTIVITY II Community Meeting

Plan a field trip to a public meeting to see what local problems are being discussed and what action is being taken on issues in your community.

ACTIVITY III Expressing Opinion

After reviewing the facts and discussing a major marine or coastal issue, have club members compose a letter to a local legislator expressing their opinion on the problem.

Possible Topics include:

. Offshore dumping or burning
. Beach Fees
. Fisheries Regulations
. Pollution

ACTIVITY IV Detecting Pollution

Water from natural sources like rivers, lakes, ponds, streams, bays, etc. is rarely pure. Use the worksheet "Indicator Species" in Appendix I for this activity.

Water in most areas contain dissolved solids. What these solids are depends on the type of ground the water has passed through. Even rainwater which is the closest to pure picks up gases from the air.

This activity will help 4-H members observe signs of water quality by looking for plants and animals which can survive various degrees of pollution. Such plants or animals are known as "indicator species" because they show us the condition of the water.

The following technique can be used at a local pond or stream, the one you regularly fish or one flowing near your home.

The technique is based upon aquatic insects. Most of these insects are the immature forms which live primarily in riffles; the shallow, swift flowing portion of a stream. There are two major groups of aquatic insects that should be present in all unpolluted waterways; the Mayflies and Caddisflies. The Mayflies have a roachlike body, thin hair like tails and six jointed legs. The Caddisflies have a maggot like body, no tails and six jointed legs.

Materials needed:

- indicator species worksheet
- cheesecloth or large white handkerchief
- plastic buckets

The sampling technique consists of the following steps:

1. Choose a local shallow stream from which to sample.
2. Remove three stones from a shallow swift moving portion of the stream. Each stone should be about 6" in diameter.
3. Place the stones in a bucket filled with stream water.
4. Brush the entire surface of each stone with your hands. If after carefully examining each stone, you are satisfied that no insects remain, discard stone.
5. Pour the contents of the bucket through a white handkerchief or piece of cheesecloth.
6. Using the worksheet, identify and count the number of insects.

Conclusions:

If only Caddisflies and Mayflies are present in quantity, the stream is probably in good to excellent condition.

If only one of the species is present then the stream is probably moderately polluted.

When the other insects such as fresh water shrimp, bloodworms and sludge worms are present they are indications of greater degrees of pollution.

Try categorizing species showing the degree of pollution in the stream.

If pollution is indicated, then proceed upstream in search of a point where the pollution indicator is no longer present. When this point is found, the pollution source is somewhere between the unpolluted spot and the last location downstream where a problem was indicated.

After discovering this problem your club may want to let officials in the community know of your results and work toward solving the pollution problem.

ACTIVITY V Make Your Own Smog

Materials needed:

- 1/2 gallon bottle
- water
- matches

Procedure:

Put 1/2 cup water into the bottle and shake it around. Light a match, let it burn a bit. Blow it out, drop it quickly into the bottle. As quickly as possible put your mouth over the bottle opening and blow hard. When you stop blowing look quickly and smell, violá-smog!

ACTIVITY VI Who's Telling The Story?

In this activity your members will be able to examine, evaluate, and discuss advertisements about natural resources and conservation.

They will analyze a commercial advertisement, discuss their impressions and feelings, then assign their own advertisement.

People show a variety of emotional responses to advertisements. Ads communicate the way we believe, think and feel. The purpose of advertising is to envoke a feeling, by design, and motivate someone to a response. Participants will evaluate an advertisement on its emotional impact and how it portrays environmental images and concepts.

Materials needed:

- magazine advertisements
- posters
- newspapers
- pens
- construction paper

Procedure:

Divide members into groups of 3 or 4.

Pass out one advertisement facedown for each group.

Ask each group to examine advertisements that portrays some aspect of the environment. Give each group 30 seconds to study the advertisement, then ask them to write down their responses.

Ask the following questions:
1. What is the purpose of the ad?
2. What image is used to sell the product?
3. Does the image have a direct or indirect relationship with the product? What is the relationship, or what purpose does the image serve?
4. What feeling does the ad portray?
5. Is the image portrayed in a realistic way?
6. Describe any ways in which the ad might contribute to practices that could be wasteful, descriptive, or inappropriate.
7. Is the ad misleading?
8. Have your members design a poster, or bumper sticker, which deals with environmental issues. These can then be shared and discussed.
   a. What is the focal topic?
   b. What is the purpose of the ad?
   c. What emotion was portrayed?
   d. What action does the ad promote?

These posters, bumber stickers could be used as part of a display to create public awareness of environmental issues.

ACTIVITY VII Future Catch

The purpose of this activity is to help 4-H members understand the importance of management of our natural resources.

Conservation, meaning to save or keep from being wasted or lost is an important term. Through various methods of conservation we protect our resources from being either used up or damaged to where they are no longer available for man.

Natural resources come in two types - those that are renewable, such as trees and fish, and those that are limited, such as coal and oil. People need to manage both so that we can continue to use them as long as we need them. Different methods can be used to manage resources.

In New Jersey, Striped Bass are valuable fish. Fishermen catch them either in the ocean or in the bay. To keep striped bass from being overfished, regulations allow fishermen to only catch them with a hook & line. In addition, their catch cannot be sold.

Clams, oysters, and scallops are very important products in New Jersey. To protect these resources from overharvesting certain regulations are imposed on the fisherman. For example; sea clammers are only allowed to fish for a limited number of hours per week. Oystermen may only harvest seed oysters during their spring bay season. Other regulations may be for size or method of catch.

Materials needed:

- small fish bowl or large-mouth jar
- two bags of "goldfish" crackers

Procedure:

In this activity members will investigate how a fish population may become overfished and how to control the problem through management.

Assign members the following roles. First generation: grandma, grandpa. Second generation: son #1, son #2, daughter #1, daughter #2. Third generation: grandchild #1, grandchild #2, grandchild #3, grandchild #4, grandchild #5, grandchild #6, grandchild #7, grandchild #8.

Tell your members that each generation wants to make a living fishing. Then begin the exercise:

1. Pour the contents of one goldfish bag in the jar or bowl.
2. Let each grandparent fish from the bowl by scooping up a handful of fish. Let the grandparents decide if this is enough fish for them.
3. Let the second generation fish in the same manner.
4. Let the third generation fish in the same manner. (Probably there will be no fish left for them.)

What have we forgotten? Fish reproduce. Repeat steps 1 through 4, but add fish. After the first generation fishes, add two handfuls of fish to the bowl. After the second generation fishes, again add two handfuls of fish. Repeat after the third generation. You should still run out of goldfish.

Who did not get enough fish? Why? How could the fish be conserved for each generation? Would you limit the number of people who could fish? Would you change the fishing method to allow use of only the thumb and forefinger? Would you allow a shorter time to fish? Would you set a limit for the number of fish that could be caught?

This exercise has no right answer because fisheries managers are still discussing these problems. Your 4-H members may evolve a better solution.

Additional Resources and Ideas

There are many resources available addressing environmental problems and issues. When choosing additional activities keep in mind their application to the marine and coastal environment.

Encourage members to "keep their eyes open" and learn how to observe what is going on. Because current problems are unresolved many opinions are expressed. Encourage your members to collect data and to look at facts to draw conclusions not just adopt a cause.

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SECTION V

Additional Marine Activities

MARINE SAFETY

Introduction

For many of us, being in, around, or on the water is always exciting. Boats and other gear used in activities in the marine and coastal areas provide many experiences. Whether working or playing in marine areas, safety is very important and not a topic to be taken lightly. This lesson deals with various aspects of safety in marine and coastal areas.

What Your 4-H Members Will Learn

- Safety procedures when in marine and coastal areas.
- Hazards to watch for.
- Boating and Fishing Safety procedures.

Background Information

Most people really enjoy being in the beautiful coastal areas of New Jersey. Safe practices when working and playing at the shore are our best defense against accidents when in, on, or around the water.

There are various aspects of marine safety depending on your activities. The commercial fishing captain has vastly different safety concerns than the swimmer or beachcomber.

Knowing things to watch out for and what to do in emergencies is a must whatever your activity in the marine and coastal environment.

One of the major concerns when in or on water is drowning. Whether swimming or boating, there are certain guidelines which are very important in avoiding accidents.

Boat Safety

Rowboats, sailboats, inboards, outboards. Whatever the craft, whatever the size, boating is one of the more popular forms of recreation. Unfortunately, some people become so involved in having fun that they are unable to recognize the dangers around them.

While safety practices naturally vary with the type of craft used, there are some general rules to remember.

Wear a life jacket. Many non-swimmers wear a life jacket when they are in the water, but neglect to put one on while riding in a boat. Statistics show that people drown each year from falling into the water accidentally. The law requires that everyone 12 years of age or younger wear a life jacket whenever they ride in a boat. The law also states there must be a life jacket available for every passenger in the boat. But that life jacket doesn't help much if you are sitting on it when an emergency occurs.

Step into a small boat. Taking a running leap off the dock into your trusty rowboat may seem like fun momentarily, but it's a good way to take an unwanted and unanticipated bath. And while getting wet may not bother you, a sudden spill may cause you to hit your head or injure yourself in some way. Step into the center of the boat when boarding or when changing seats, and keep your body as low as possible to maintain the boat's balance.

Don't ride in an overloaded boat. Too many people or too much equipment makes a boat ride lower in the water where it can easily take on water and sink. This is especially true if the water gets a bit rough. Many inboard/outboard manufacturers put a plate on the boat's transom that shows the recommended weight capacity in number of persons as well as in number of pounds for people, motor, fuel and gear.

Use the right size motor. Too much power can damage your boat or even swamp it. The metal plate on the boat's transom shows the recommended maximum horsepower.

Don't ride on the bow of the boat. Those who ride in this dangerous location could be thrown into the water accidentally. If riding in a motor boat, they could be sucked into the propeller before the engine could be stopped. Ride in the seats provided, or in the bottom of the boat. Sitting on the sides of the boat is just as dangerous because any sudden lurch could toss you overboard.

Avoid sharp turns. These are hard both on equipment and on people. Take it easy and avoid accidents.

Don't lean out of the boat. You see something move just below the surface of the water, so you lean over to get a better view. You could lose your balance and fall into the water, or you could change the balance of the boat enough to make it turn over. Standing or moving about in a small boat while it is underway could have the same results.

Don't drive a boat near swimmers. If you are old enough to drive a boat, you are old enough to realize that horseplay has no place behind the wheel. Buzzing swimmers, skiers or other boaters could result in tragedy. Use common sense and follow boating traffic rules.

Use lights when boating at night. The law requires that a boat be equipped with lights if it is used after dark. Lights serve as a warning to other boaters and should never be turned off when you are moving about on the water at night. If you don't have lights, remember you will need to allow plenty of time to get back to the dock before sunset.

Stay with your boat. A capsized boat is one of the most common accidents. Don't try to swim for shore unless there is a good reason to do so. Modern boats will hold up passengers even when full of water. Also, remember, it is easier to spot a boat than a swimmer's head in the water.

Hopefully, you will be wearing a life jacket before a boat ever capsizes. If not, look for anything that will help keep you afloat--coolers, gas can, water containers. Unless the water is cold, it is usually best not to try to climb onto the boat. If this is necessary, try to climb on from the stern (front). Be careful as it is easy to slip and get hurt or to dislodge other people.

The three most important things to do are **hold on, keep calm** and **wait for help to come.**

Sailing is one of the faster growing sports in the state. Sailing also is remarkably safe since the sailor must be closely attuned with both wind and water to move the craft.

Accidents do happen, however, and lives are needlessly lost. Remembering a few precautions might make the difference.

Wear a life jacket. One of the most common sailing accidents involves being hit by the boom during an unexpected change of course. If you are knocked overboard, you also may be unconscious, making swimming skills useless.

Know how to right a capsized sailboat. All small boat sailors should practice capsizing the boat on purpose and righting it with the supervision of a more experienced sailor.

Stay with your craft. If you can't right the boat, stay with it until help arrives. This is the rule even when the shore seems close by. There are too many instances of people setting off for shore who are never heard from again.

Wear rubber soled shoes and good sailing gloves. Improper shoes can cause a skid over the side or a painful fall. Gloves will prevent rope burns.

Watch the weather. Accidents sometimes happen when the sailor fails to notice changing weather, or waits too long to act.

Swimming Safety

Swimming is lots of fun and a real natural at the Jersey shore, but there are some precautions that apply in any water.

Humans can't breathe water. Water may contain oxygen, but it's not usable by the human respiratory system. If water covers your nose and mouth, and you are unable to surface to breathe air, you will suffocate. Suffocation by water is known as drowning. Your best insurance against drowning is learning to swim. If you can't master the complete technique, at least learn to tread water so you can yell or wave your arms for attention should you find yourself in difficulty.

Water doesn't have to be deep to be dangerous. People drown in shallow water just as fast as they drown in deep water. All too frequently there are reports of children drowning in bathtubs. If you slip and fall face down in only three inches of water, you will drown if you are unconscious or unable to turn your head enough to clear one of your breathing passages.

Never swim alone. Even the best swimmers occasionally need help. If you get a leg cramp or find yourself in some kind of difficulty you will be glad there is someone around.

Know the body of water you are in. You may be an expert in a swimming pool yet could find yourself in a potential drowning situation in the surf when confronted with rip currents, sand bars and deep holes.

A rip current is a strong, narrow outflow of ocean water which moves away from the shore carrying back out to the ocean those waters brought in by normal wave action. The rip current is part of a generally circular pattern of water movement natural to most long, gently-sloping sand beaches. This current can travel at speeds of up to two or three miles an hour and changes its position often.

The rip current breaks up the normal wave pattern, one which runs parallel to the beach. Instead of being parallel to the beach, the rip current flows in a line perpendicular to it. Because of this, small choppy waves may form in a band from the shore out to the surf zone. This rough water often creates a foam line which will show you the location of the rip current.

Once outside the surf zone, the rip current dies rapidly, spreads out, and often forms a large sluggish eddy called a "rip head." A beach may have several rip currents moving at one time and then go for weeks without any at all.

There are a number of simple rules about rip currents that you should know and follow before going into the ocean waters this summer:

. LOOK FOR A BAND OF ROUGH, CHOPPY WATER running from shore to surf line which has foam on it to identify a rip current. Sometimes if you look at the end of a jetty, groin or other solid structure that juts out into the ocean, you will be able to see a rip current where the water has been deflected seaward. If you recognize the rip current, stay away from it.

. IF YOU FEEL A STRONG CURRENT PULLING AT YOUR LEGS AND GOING OUT TO SEA as you are walking from the beach into shallow water, look farther out into the water and you may be able to see the rip current moving out to sea.

. IF YOU NOTICE THAT YOU ARE MOVING QUICKLY IN ONE DIRECTION ALONG THE SHORE while you are in the water, you should expect rip currents to be developing.

. THE BOTTOM WILL SEEM AS IF IT IS MOVING TOWARDS THE SHORE if your feet touch the bottom occasionally as you are swimming in a rip current. This means that you are being carried by fast moving water away from the shore. Another gauge of how fast you are moving out to sea is your movement relative to other swimmers around you.

This is the point at which most swimmers make a mistake. They panic and try to swim towards the shore as fast as possible. This frantic swimming is both exhaustive and useless. You cannot fight the rip current by swimming directly into it.

There are two alternative ways of getting out of the rip current:

. YOU CAN SWIM PARALLEL TO THE BEACH, since the rip current is only ten to twenty feet wide. This will carry you out of the rip current and allow you to get back to shore easily.

. YOU CAN RELAX AND LET THE RIP CURRENT CARRY YOU SEAWARD through the surf zone into the rip head where the current slows down and dissipates. You can then swim to shore, well away from the narrow rip current!

If you follow these simple rules, you will avoid the rip current at the shore and enjoy a safe outing at the beach this summer. Know your environment, and remember familiarity with one body of water doesn't necessarily transfer to another.

When possible, swim where trained lifeguards are on duty. This may be at a public swimming pool, a beach or along a lakefront. Swimming in an unguarded pool or from unguarded beaches is not always dangerous; it only means you are more responsible for your own actions.

Don't overexert yourself. Swimming when you're tired is asking for trouble. Staying in cold water too long also can cause hypothermia (a loss of vital body heat). When you start shivering or your lips turn blue, get out, dry off, and give your body temperature a chance to return to normal.

Don't overestimate your swimming ability. Nine out of 10 people, when asked, will probably say they are "good" swimmers. What's "good"? Good enough to win a race, or good enough to keep your head out of the water? Even if you are an excellent swimmer, remember you shouldn't try to swim as far in March as you could the previous September unless you have been swimming on a regular basis. Your body is out of condition and you may not be able to make it across a pool, let alone back to shore in the bay or ocean. Also keep in mind that distances on water are deceiving; the other side of the cove is farther away than it looks.

Don't rely on inflatables. Inner tubes, plastic air matresses and that puffed-up replica of Jaws may have a place, but it certainly isn't deep water--either the deep end of a swimming pool or in open water. Too many times the unexpected happens--the inflatable springs a leak, you lose your balance or someone accidentally tips you over. Whatever the cause, the result is the same--you suddenly find yourself in water over your head with the inflatable out of reach. For a non-swimmer, this may prove fatal.

Some precautions don't apply to swimming pools, but the attractions of New Jersey's beaches, lakes and waterways make these natural sites popular with swimmers too. Consider their varied characteristics and hazards before you take the plunge.

The ideal swimming site should have a gently sloping bottom with a large area of shallow to chest-deep water. There should be no deep holes or drop offs and the bottom should be clear of stumps, sunken logs or large rocks. The bottom covering should be sand, gravel or shale, rather than deep silt or muck, and watch out for sharp objects and broken glass.

Don't dive into unknown waters. Each year swimmers dive into water that is too shallow or they hit underwater objects that either break their necks or knock them unconscious. The depth of the water must be equal to the distance of your dive, otherwise you are taking an unnecessary chance. Diving or jumping from a tree limb or cliff poses another danger as well. The force of your body hitting the water incorrectly can break bones, or, at the very least, knock the breath out of you.

Be alert for underwater vegetation. Swimmers have drowned after becoming entangled in weeds. This underwater hazard can be especially dangerous if you fall into thick vegetation.

A few good rules to follow anywhere along the beach include:

- Do not swim in water more than waist deep; stay in even shallower water if you can't swim.
- Do not swim if you're sick, tired or if you've been using alcohol or drugs.
- Do not swim in boating or surfing areas.

- Do not swim during thunderstorms or in strong wind.
- Stay at least 100 feet away from rock jetties, groins and piers. Strong currents form there and they cut deep holes in the bottom.
- Be alert for sea animals which may stick, bite, sting, cut or even shock you. Get out of the water if you encounter one and seek immediate medical attention if you are injured.

Finally, **wear a life jacket.** Many non-swimmers wear a life jacket when they are in the water, but they fail to do so when wading in the surf, walking on a dock or pier, fishing from a bank or riding in a boat. Many of the recreational activities identified with drownings, such as wading, boating, hunting and fishing, do not require swimming skills per say. Tragedy often results when the person is immersed unexpectedly.

Field Trips and Special Marine Activities

A field trip along the shore may seem very safe but there are a few things to remember.

Always Wear Shoes - some of the best places for observing marine and coastal life have many hazards for your feet. Broken shells, bottles, hooks, nails, etc., are often in the sand or lying just below the surface in shallow water. Don't take chances. Keep your "old sneakers" handy and wear them at all times.

Wait for instructions on where to go. Jetties, piers, marshes and docks can all be dangerous if you don't know where you are going or how to travel on them. Rocks and wood washed with water, mud, marsh grass and the like, can all be very slippery so proceed with caution. **Walk, Don't Run.**

Sometimes on field trips you will encounter marine organisms which can sting, scratch or bite. If you have questions about what you have found, ask before you pick it up. If you get cut, bitten, scratched, etc., the wound should be cleansed with an antibacterial agent and covered with an antiseptic.

Don't leave the group and go off alone. Always stay with another person and keep the group in sight if possible.

Follow instructions. There is always a reason for instructions on a field trip or special marine activity. Listen and do as you are told.

Safety on Commercial Fishing Vessels

In terms of safety, it is the duty of every commercial fishing vessel owner to provide a seaworthy vessel for his crew and to keep the work environment as free as possible from recognizable and avoidable hazards that could cause physical harm.

Many accidents at sea can be avoided by close observation of work practices, by attention to design and details of the equipment, by safety education and by promotion of safety awareness among crew members both for their own safety and the safety of others aboard. Safety on a fishing vessel begins with the boat itself.

One of the methods used on commercial fishing vessels to insure safety is a series of safety inspection checklists. There are six basic areas to check on any vessel. These include; safety equipment and alarms, deck, engine room, living quarters, galley and wheelhouse.

A second area for attention in insuring safety on fishing vessels is safe work practices. General safety rules and operations for safe fishing must be impressed upon the crew.

Example:

- When tying up, always place your hands over the line, never underneath the line. Keep fingers from in between lines and solid objects. Make certain adequate slack is present in the anchor line before making wrap on anchor cleat.
- Become familiar with emergency procedures and all alarms and whistles.
- Do not go into the fish or shrimp hold until you are sure of proper ventilation and no dangerous or poisonous gases are present. Do not go into the hold without notifying a fellow crew member.

Finally, the attitude and knowledge of the crew is an important factor in marine safety. Captains must try to hire the best crew available and provide proper safety orientation and training.

Preparing For The Meeting

A lot of information on marine safety is contained in this lesson. Do not try to completely cover the topic in one meeting. Choose one aspect and read the material carefully. If possible secure some of the additional resources to help you cover the topic. Avoid lecturing and involve the members as much as possible. A sample vessel inspection form is available in Appendix I. This may be used with Boating or Commercial Fishing Safety.

Involving The 4-H Members

The topic of safety is probably not one of the more exciting aspects of the marine science project, but one of great importance.

When covering each of the topics, encourage members to be involved.

Some ideas:

Discuss why it is important to be safe? What can happen if we don't take safety precautions?

Why is safety important to a fishing boat captain?

Members may draw safety posters which can be used in a display to increase public awareness of marine safety.

Contact a resource person to talk to the group about various aspects of marine safety. Possible resources include; a person who operates a recreational boat, fishing boat captain, person in the Navy or Coast Guard, a swimmer, a lifeguard, first aid instructor or swimming coach.

A possible field trip might be to contact someone who owns a boat and would allow the members to conduct a safety inspection of the vessel (worksheet "Vessel Inspection Report" in Appendix I).

Additional Resources and Ideas

Boating Safety for Sportsmen - USCG BOSTEAM 3, U.S. Coast Guard, Governor's Island, New York, New York 10004, or New Jersey Marine Police, P.O. Box 1889, Trenton, N.J. 08625.

Boating Rules of the Road - U.S. Coast Guard, Department of Transportation, Washington DC 20590.

PFDs for Safety - Department of Environmental Protection, Division of Coastal Resources, New Jersey Marine Police, P.O. Box 1889, Trenton, N.J. 08625.

Protective Gear and Safety - National Marine Fisheries Service, National Oceanic and Atmospheric Administration, Public Affairs Officer, 3300 Whitehaven Street, N.W., Washington, DC 20235.

Boats and Fire: A Dangerous Combination - U.S. Coast Guard Directory Auxiliary, Governor's Island, New York, N.Y. 10004.

Lightning: A Threat to Boaters - National Oceanic and Atmospheric Administration, National Weather Service, 8060 13th Street, Silver Springs, Maryland 20910.

Radar Reflectors: Boat Insurance We Can All Afford - Extension Marine Advisory Program, Sea Grant Communications, Oregon State University, Corvallis, Oregon 97331.

Rip Currents and Swimming Safety - National Oceanic Atmospheric Administration, Public Affairs Officer, 6010 Executive Boulevard, Rockville, Maryland 20852.

Hypothermia and Cold Water Safety - Dr. M.L. Collins, University of Victoria, Victoria, British Columbia, Canada V8W242.

Cold Water Drowning - Michigan Sea Grant, 2200 Bonisteel Boulevard, Ann Arbor, Michigan 48109, or U.S. Coast Guard, USCG BOSTEAM 3, Governor's Island, New York, N.Y. 10004.

Water Safety: How Safe Are You? - Marine Information Service, Sea Grant college Program, Texas A&M University, College Station, TX 77843.

Safety At Sea: A Guide for Fishing Vessel Owners and Operators - Marine Information Service, Sea Grant College Program, Texas A&M University, College Station, Texas 77843.

Water Safety & You - Susan Bonsall, New Jersey Marine Advisory Service, Rutgers, the State University, New Brunswick, N.J. 08903.

References

Hollin, D. Safety at Sea: A Guide for Fishing Vessel Owners & Operators. Texas A&M University, September 1982.

Bonsall, Susan. Water Safety and You. Rutgers University and N.J. Marine Sciences Consortium.

Water, How Safe are You?. Texas A&M University, February 1982.

FISHING

Introduction

Imagine sitting in the sun on the bank of a nice calm blue lake. You watch the clouds roll by as you wait for the "big one" to take a nibble. Sound fun? Lots of people really enjoy the sport of fishing whether it's sitting on a quiet bank or going on a boat for deep sea fishing. In this lesson, 4-H members become better acquainted with fish and the sport of fishing.

What Your 4-H Members Will Learn

. basic information about parts of a fish and their habitats
. basic fishing skills

Background Information

External Parts of a Fish

Dorsal Fin is usually used to help a fish maintain its balance. Some fish have one, some have two, some have none at all. The dorsal fin may also contain hard spines which aid in defense.

Caudal Fin is the fish's tail. Some fish move their bodies by thrusting the tail back and forth. For other fish, the tail serves as a rudder or a stabilizer, with propulsion coming from the body movements or other fin movement.

Anal Fin often serves as a keel to help maintain balance. This fin is sometimes armed with sharp projections. When these supporting rods in fins are soft, they are called rays. When they are hard and stiff, they are called spines.

Pelvic Fins are comparable to our legs. They are primarily used for fine adjustment of the fish's movement: steering, stopping, and maintaining balance; but may be modified for special functions, such as crawling along the bottom, holding or grasping.

Pectoral Fins are comparable to our arms and are also used for fin movements particularly turning and staying in one place. They may be modified for special functions or, in some fish, absent.

Gill Cover, or operculum, is a flap that covers and protects the delicate red gills found underneath. Fish get their oxygen from air dissolved in the water.

Scales are modified skin cells that help protect the fish from abrasions and skin diseases. If you look at a scale under a microscope, you will see rings similar to rings you see in the cross section of a tree. Spacing between the rings narrows as fish growth slows each winter. The age of the fish can be determined by counting the number of areas on the scale where slow growth is exhibited.

The Lateral Line - The water fish live in is sometimes turbid, usually in motion and often dark. Therefore, fish often cannot depend on light to find food or its way around. Instead, it uses a special sense organ, the lateral line. This is a series of pits in the skin that look like a dotted line. The nerve cells in these pits are sensitive to changes in pressure and tell the fish how deep it is, how wavy the water is and what sounds are present. Fish use the lateral line to help them form schools, find food, avoid predators and sense temperature changes.

Eyes vary in size and color from fish to fish. Most fish lack eyelids since their eyes are constantly bathed in water. Most fish can't see very well--they are nearsighted, and some cave fish lack eyes completely. Many fish see color.

Mouth - Fish have big mouths, tubular mouths, flexible mouths, mouths that point up, and mouths that point down. Some mouths have razor sharp teeth and some mouths have no teeth at all. The special functions of the mouth aid the fish to get food to eat and to help protect itself.

Teeth - Most fish swallow their food whole. Those that have teeth exhibit a wide variety--some with big, sharp teeth to catch and hold prey, others with bristly teeth to scrape off algae, or flat and heavy teeth for crushing hard shelled animals. Fish may have teeth on their jaws, on their tongue, on the roof of their mouth or near their throat.

Nares - Fish have nares, comparable to nostrils. They are used to smell odors in the water, not for breathing. Some fish are able to smell things located miles away.

Ears - Fish ears are not external. Sound travels faster and further in water than in air. Fish are surrounded by water and have no need for an external ear opening. The sound is transmitted through the water, directly through their skulls, and into their ears. They probably cannot hear fishermen talking very well, but can hear the movement inside a boat.

Taste - Fish have taste buds and many species have proven their ability to taste sour, salt, and bitter. But no fish have been found that can taste sweet. Some catfish have tastebuds all over their bodies.

Learning about how and where fish live is very important knowledge when you're trying to catch them.

Habitats

A fish's shape is a clue to where it lives, how it eats and how it will behave when hooked. Here are some clues:

Deep Sea Dwellers - spindle shaped body - These fish depend on speed to escape enemies as well as to find and catch food. They are strong fighters. Tuna, Marlin and Swordfish are three types.

Bottom Dwellers - flat chunky body - These fish are slow swimmers. They don't fight when hooked but pull to go deeper in the water. Examples include flounder and catfish.

Open Water Dwellers - compressed body flattened from side to side - These fish swim freely in quiet waters between the bottom and the surface. Sunfish, bluegills and weakfish are open water dwellers.

Fish, like all animals, have basic needs; shelter, space, water/oxygen, and food. These elements are needed for a fish to have a good habitat. Learning about the needs and habits of fish will help you be a better fisherman.

Basic Fishing Tackle

The place to begin fishing is with the proper equipment. Fishing tackle consists of rod, reel, line, leader, sinker and hook. When buying fishing tackle go for what catches fish and not your eye. Choose tackle which is appropriate to the type of fishing and the type of fish that you have access to.

When buying tackle you should know the purpose, function and use of each piece of equipment.

Rods - furnish the leverage for casting and for setting the hook. Rods may be made of wood, steel, split bamboo or almost any material. Most rods today are made of fiberglass and plastic.

Reels - the devices on which line is stored. Line can be released or retrieved by the reel. Principle types of reels are fly, bait casting, spin casting, spinning and saltwater. All reels come in various sizes.

Lines - range from thread to rope. Most lines are rated in pound test. Pound test means the maximum weight in pounds they will lift without breaking.

Leaders - may be used to make a nearly invisible connection between the line and the lure, thus helping to deceive the fish.

Sinkers - lead weight molded in various shapes and sizes. Used to hold the bait where you want it in the water.

Hooks - catches the fish. All other tackle serves to get the hook to the fishes mouth. The type of hook used depends on the type of fishing.

In addition to the basic tackle you may add accessories as needed. Nets, gaffs, bait buckets, tackle boxes, etc., are samples of fishing accessories.

Tools

Tools of many varieties may be helpful to the fisherman. Some include:

Clippers	cutting lines
Pliers	making leaders, repairing tackle
Hone	sharpening hooks and knives
Knife	cutting bait and cleaning the catch

Fishing Skills

The three basic skills in fishing are:

Casting The Line
Hooking The Fish
Landing The Catch

There are many ways to get the bait into the water and many methods of fishing. **Casting** takes practice but is a necessary skill in fishing. **Hooking the Fish** is basically jerking the line at the right moment to set the point of the hook in the fish's mouth. Methods of setting a hook depend on types of bait and methods of fishing. **Landing the Catch** is the final payoff for any fisherman. After the fish has been played out it can be landed by hand net, gaff or simply lifted out of the water. When landing a fish take your time. Many fish are lost because the fisherman got excited and tried to hurry.

After catching your fish be sure it is properly cared for. Fish must either be kept alive or cold and moist until they can be cleaned.

Preparing For The Meeting

The information included in this lesson is extremely basic. To properly teach your members how to fish, it is important to look at one of the pocket guides or "How To" books available in either the library or a book store. The best method for teaching fishing is to get involved, experience the thrill of catching fish and learn along with your members. Look over the activities available in this lesson and choose activities appropriate for your group.

There are several activities that may be conducted at club meetings before actually going fishing. You may want to review some of the prior lessons on habitats to discuss how and where fish live. Utilize the worksheet "Parts of a Fish" in your discussions.

Involving The 4-H Members

ACTIVITY I Parts of a Fish

Using the worksheet, "Parts of a Fish" in Appendix I, have members name and discuss the parts of a fish.

Examine a live fish or a variety of live fish and compare them to the diagram.

- Do all species have the same external features?
- Do all fish have the same fins?
- Do the fins have rays or spines?
- Look at the mouth and teeth. Can you tell what or how the fish eats?
- Does the fish have scales?

ACTIVITY II Habitat Game

This activity can have a lot of impact on the 4-H'er trying to understand habitats. Ask each 4-H'er to number off one, two, three, four, one, etc. Have the number one's, two's, etc., each form their own group. Assign each group one of the basic needs, i.e., one's = shelter, two's = space, three's = water/oxygen, four's = food.

Now it is time to form a circle. This is done by building the circle with chains of shelter, space, water, food, etc. A 4-H'er from each group gets in line until all one's through four's have completed a circle. All 4-H'ers should stand shoulder to shoulder facing inward.

Ask the 4-H'er to turn to the right and take one large step toward the center. They should be standing close together with each looking at the back of the one in front of them. Ask everyone to place their hands on the shoulders of the person in front of them and listen carefully. At the count of three, everyone should sit down on the knees of the person behind them, keeping their own knees together to support the person in front of them. The leader says, "shelter, space, water/oxygen, and food in their proper arrangement are the four basic needs of fish. This is what is needed for a fish to have a good habitat."

By this time the 4-H'ers will have either fallen, or the circle will most likely be disrupted. When the laughter has stopped, the leader can talk to them about the fish habitat and how everything is dependent on everything else.

After the 4-H'ers understand this habitat--that survival is dependent on the proper balance of these four components--have them try the lap sit again. As the 4-H'ers sit on each other's knees, still representing shelter, space, oxygen and food, identify that there is a problem with one of the needs. For example, a large spill of a toxic substance into the water has interrupted the amount of oxygen in the water. Have all of the 3's (oxygen) step out of the circle. After the circle has collapsed or at least suffered disruption, the leader can talk about the impact outside factors have on the habitat and the fish that live there. Since fish depend on all four needs, disruption or removal of one will have an impact.

For Discussion:

What are the four basic needs of all animals?
Food, Water/Oxygen, Shelter, Space.

What is habitat?
The environment in which an animal lives.

What happens if one of the basic needs is disrupted or eliminated?
It will have an impact on the fish population, either killing off many or possibly eliminating the whole population.

How do water plants fit into the four basic needs of fish?
Water plants may be used for shelter and will affect the amount of oxygen in the water.

What is an example of a disrupted habitat?

What does this activity mean to you?

What types of habitats for fish do we have in our area?

What types of fish can be caught there?

*adapted from an activity called "Habitat Lap Sit" published in Project Wild.

ACTIVITY III Stocking Your Tackle Box

Discuss with your 4-H members the items needed for a well stocked tackle box.

Name the different items and discuss their purpose or function.

ACTIVITY IV How to Buy Tackle

Plan a field trip to a sports equipment store to take a first hand look at fishing gear.

Find out what type of gear is best for catching specific types of fish.

Before the trip, have your members make a list of what is needed for a tackle box. At the store, determine the prices for each item and the total cost of getting started.

Have members plan their tackle boxes based on fish they most often catch in your area; not species they would like to catch.

ACTIVITY V Go Fishing

Choose a local spot for fishing and plan a fishing trip.

You can plan to cook your catch or freeze them to use later for fish prints.

Additional Resources and Ideas

New Jersey Marine Fisheries Handbook 1986. New Jersey Department of Environmental Protection, Division of Fish, Game and Wildlife, 363 Pennington Avenue, CN400, Trenton, New Jersey 08625.

How To Catch Fish In Salt Water. Fisherman's Information Bureau, 20 North Wacker Drive, Chicago, Illinois 60606.

How to Catch Fish In Fresh Water. Fisherman's Information Bureau, 20 North Wacker Drive, Chicago, Illinois 60606.

Check your local library, book store or sports shop for fishing guides that carry indepth information on various types of fishing.

References

Beginning Angler 4-H Leaders Guide. University of Minnesota.

Fichter, George S. and Phil Francis. Fishing. Golden Press. New York, N.Y., 1965.

BETWEEN CATCH AND KITCHEN, WHAT TO DO???

Introduction

You've caught it, now what do you do with it? If throwing them back does not seem to be your 4-H member's style, this lesson will help you to teach basic information on handling fresh shellfish and finfish. It includes instructions on how to prepare the catch for eating.

What Your 4-H Members Will Learn

. how to keep and clean finfish and certain types of shellfish

Background Information

The final step of shell and finfishing is preparing your catch for cooking and eating. This step requires some practice but once you get the hang of it, it isn't too difficult.

An important thing to remember in preparing all seafood is that it is highly perishable and requires refrigeration. Be sure to keep seafood cold until it's cooked or eaten.

Seafood right out of the sea has no "fishy" odor. The strong smell starts when bacteria begins to break down the tissues.

Finfish

Scaling - Wet fish with cold water before scaling. Hold the fish firmly by the head on a flat surface. Working from tail to head, scrape off scales with a knife or fish scaler. (Make sure to remove scales around head and all the fins.)

Cleaning - Using your ultra sharp knife, cut the entire length of the belly from tail to head. Remove the intestines and all blood and black streaks.

Heading - Remove the head and pectoral fins by cutting above the collar bone through the flesh to the backbone. Cut the other side the same and snap the backbone to remove head. Cut off tail if desired. Wash fish thoroughly in cold running water. The fish is now dressed.

Removing The Fins - Cut around the pelvic and ventral fins and pull them out. Remove the dorsal fin by cutting along both sides and pull it towards the head. (Do not cut fins off, or you will not be removing the small bones at the base of the fins.

Cutting Steaks - Large dressed fish can be steaked by cutting crosswise severing the backbone. Steaks are usually cut 3/4" - 1 1/4" thick. Large fish may require a saw to cut through the backbone.

Filleting - Using your super sharp knife cut the flesh along the back of the fish from tail to the head. Cut down to the backbone just behind the head. Now hold the knife flat and slide it between the flesh and the backbone, removing the flesh in one nice piece all the way to the tail. Flip fish over and repeat the process. Do not be discouraged, filleting a fish takes a little practice.

Skinning - Skinning a fillet is easier when it is unscaled. Lay fillets on a flat surface with skin side down. Hold tail and cut through flesh to skin along the base of the tail. Hold knife flat between flesh and skin. Cut flesh away from skin by running knife forward toward the head while holding the tail end down firmly. Skinning is much easier if you use three hands.

Shellfish

A word of warning; if a harvested shellfish has its shells parted, leave it alone. Chances are it is dead or unhealthy. You do not want to risk getting sick by eating it. The most common shellfish harvested by recreational fishermen in New Jersey are clams, oysters, crabs and mussels. Before opening, all shellfish should be scrubbed with a brush under cold running water to remove the dirt. Clams, oysters and mussels are cleaned by opening or shucking. This process takes practice and you must be very careful. The tool used can be any small knife but it is best to use one designed for the purpose. The shucking knife has a finger long blade with a handle about the same length. The blade is flat and thin, but not sharp. The following instructions are for opening a clam. They are written for righthanded people so if you are lefthanded reverse the procedure.

Pick up the clam in your left hand, knife in the right. Work one edge of the knife into the tiny space between the shells. As soon as the knife penetrates, slide it back and forth from one end of the rim to the other, cutting the muscle that holds the shells fast. Open up the shell and rinse off the clam's soft parts to remove sand.

If you have trouble getting the knife in, try the following trick. Drop the clams into a pot holding a few inches of water and heat it. The heat will make the clams open up enough for you to insert the knife easily. This technique can be used with similar shellfish as well.

Oysters are a lot more difficult to open. Once again be very careful.

The traditional way to open oysters is to work your knife edge between the shells, while holding the oyster from its hinged side. Cut the muscles and pry the shell open. Often, however, it is very difficult to wedge your knife between the shells. So try brute force. Place the oyster on a table with its round shell up. Take a hammer or wooden mallet and rap the edge of the shells until a piece breaks off, leaving an opening. Then insert your knife and go to work. Once the oyster is open, wash it off under the tap. Scoop out the flesh by cutting in from the shell.

You can store oysters for many days, even weeks, under the right conditions. They should be kept cool and moist. One way is to wrap them in burlap inside a pail and keep them dampened with seawater. Another is to refrigerate them, remembering to dampen them, with saltwater if possible.

Crabs are completely different to clean. Often people steam crabs before cleaning and then pick out the crab meat. (Refer to the lesson "Preparing Your Catch" for information on steamed crabs.)

To clean crabs, open the tail flap on the bellyside and pull it against the back major part of the shell, removing both. Sometimes a sharp knife may be necessary to complete the job. Take out and discard the spongy substance under the shell. Split the crab body to pick out the meat, discarding the gills, intestines and sandbags. Claw meat can be released with a nutcracker. From a 5 oz hard shell crab you can expect about 1 1/2 ounces of meat.

Some guidelines for storing:

Finfish - Cover fresh caught fish immediately with crushed ice. Add seawater to lower the temperature and make the ice slushy. Keep fish iced until either cooked, refrigerated or frozen.

Clams - May be stored at least overnight in the refrigerator.

Oysters - You can store oysters for many days under the right conditions. They must be kept cool and moist. One way is to refrigerate them. Remember to dampen them with saltwater if possible.

Crabs - May be stored at least overnight if refrigerated. Crabs must move to be edible. Do not cook and eat dead crabs.

Preparing For The Meeting

Read the provided information carefully. You may either present this material demonstrating as you go along or you may want to combine this lesson with a field trip to a fish market and ask the person at the market to demonstrate. Included in Appendix I is an activity sheet entitled "Cleaning Your Catch" for use with this lesson.

Involving The 4-H Members

You can discuss the procedures with members as they are being demonstrated. You also will want to discuss each of the species, their habitat, characteristics and behavior.

Additional Resources and Ideas

Field guides on marine organisms are available to identify and discuss the species. You may want to focus on one species at a meeting and combine it with a cooking experience. A seafood cookbook will be an excellent resource or refer to the activity sheet on "Cooking Your Catch".

References:

Dock to Fish: What To Do With A Fish. Wildwood, NJ: Eat More Fish Inc. 1981.
Ricciuti, Edward R. **Secrets Of Shellfishing**. Connecticut: Hancock House Publishers. 1982.
Rombauer, Irma S.; Becker, Marion Rombauer. **Joy Of Cooking**. New York: Bobbs - Merrill Co., Inc. 1975.

SHELLS AND FINS

Introduction

Seafood has been referred to as "the ocean's natural health food". High in protein and low in calories, seafood is a delicious and nutritious food source. In this lesson 4-H members will become familiar with the two types of seafood as well as various techniques for selection and preparation of each.

What Your 4-H Members Will Learn

. the distinction between finfish and shellfish
. Characteristics of fresh seafood
. varieties of seafood

Background Information

Seafood is all edible animal foods taken from the water either saltwater or freshwater. Seafood may be either finfish or shellfish.

Some types of seafood available in New Jersey include:

Saltwater Fish - cod, flounder, sole, haddock, halibut, herring, ocean perch, pollock, red snapper, salmon, swordfish, tuna, whiting, drum fish, bluefish, weakfish, kingfish, rockfish and tilefish.

Freshwater Fish - bass, carp, buffalofish, trout, catfish, herring, pike, whitefish and yellow perch.

Shellfish - clams, oysters, scallops, crabs, lobsters mussels and shrimp.

Seafood can be purchased in a variety of forms, mostly canned, frozen or fresh.

When purchasing finfish, you will generally find it in one of these forms.

Round or whole - just as it comes from the water.

Dressed or Pan Dressed - minus scales, internal organs and usually head, tail and fins.

Fillets - lengthwise slices from the meaty sides of a fish. Fillets are practically boneless.

Portions or Fish Sticks - usually breaded or coated with batter, usually partially cooked and frozen.

To get the best buys in seafood, you need to know a few basic pointers.

In buying whole or dressed fish, be sure the eyes are bright and bulging and that the gills are reddish in color. If the fish has not be scaled, the scales should be shiney and still attached to the skin. Fish should have a mild odor. In buying fresh already shucked (removed from the shell) oysters or clams, the flesh should be plump and creamy, the liquor or juice clear and odor fresh and mild. In buying live oysters or clams in the shell, the shells should be closed or should close tightly when tapped. Gaping shells mean that shellfish are dead and therefore inedible.

Seafood is highly perishable and should always be kept cold, preferably on ice. Seafood refrigerated properly may be kept for several days but is best when eaten on the day purchased or the next day.

The best way to find out what seafood is available in your area is to look. Supermarkets and fish markets are the best places to purchase seafood.

Preparing For The Meeting

Familiarize yourself with the background information. It provides a basic background for purchasing seafood. The activity for this lesson is a field trip to a fish market or supermarket to look at available seafood. Read over the guidelines and prepare for the activity so that the activity will run smoothly. You may want to review marine organisms and adaptations before presenting this lesson.

Involving The 4-H Members

Discuss various types of seafood and their value in the diet. Refer to the lesson "Netting Seafood Nutrition" to discuss nutrients found in seafood. Have members complete the activity sheet "Fins or Shells". Discuss which types of seafood members have eaten. Which ones are their favorites?

Activity I - Visit A Fish Market

Plan a trip to a fish market. Check the newspaper for advertisements of fish markets. Talk to the owner in advance so that you can plan to go when it isn't too busy.

Arrange a filleting, cleaning, shucking or other demonstration while you are there.

To help your members gain additional knowledge from this experience have them prepare by finding the answers to the following questions.

1. How many different types of fish are sold at the market?

2. Which fish and shellfish come from New Jersey waters?
   From saltwater?
   From freshwater?

3. How can you tell the difference between a walking crab and a swimming crab?

4. How are flounder adapted to their environment?

5. How can you tell that a fish is fresh?

6. How are mussels adapted to their environment?

7. Can you find the part of the fish that allows it to breathe under water?

8. List all the animals in the market that have shells.

9. How are squid adapted for their environment?

10. How are finfish adapted for a life in the water?

11. Find out how scallops move.

12. What are fillets; how are they prepared?

13. Does the shape of the animal reveal how fast it can move in water?

14. What proportion of the fish is edible?

Discuss 4-H member's findings.

Activity II - Supermarket Scavenger Hunt

Plan a field trip to the supermarket. Using the activity sheet "Seafood Scavenger" locate various forms of seafood. Talk to the manager in advance and see if he can provide any special help or special demonstration. Discuss what 4-H members find in the supermarket.

Additional Resources and Ideas

Have 4-H members keep track of seafood that they eat. Discuss seafood eating patterns of 4-H club members.

An excellent supplement to this lesson is preparing a seafood dish. There are many seafood cookbooks available, review some of the recipes available and choose a club favorite.

The Sea Grant Program, Rutgers Cooperative Extension at Cook College, Rutgers University or the New Jersey 4-H Marine Sciences Consortium are an excellent resource for pamphlets on seafood.

You may want to talk to the Extension Home Economist in your county for additional resources.

References

A Seafull of Facts About Fish. Kraft Foods Inc. 1980.
Mid Atlantic Seafood, The Incredibly Easy Entree. Mid Atlantic Fisheries Development Foundation, Inc.
Webb, Anita H.; Howlett, Sandra E.; and Kimmich, Anita E., **Seafood Products: An Instructional Guide For Home Economics Programs**. Blacksburg: Virginia Polytechnic Institute and State University.
O'Dierno, Linda. **Fish Market Biology**. Wet Worlds, Coastal Education Curriculum Project. New York Sea Grant Program.

NETTING SEAFOOD NUTRITION

Introduction

Even you weakies can show your mussels in the kitchen. Try these recipes just for the halibut. Don't clam up, scallop the neighbors and have a whale of a good time. As long as you've got sole, there's no need to crab. Even if you flounder, they'll know it wasn't on porpoise.

Now here's the snapper if you play your cods right, those little shrimps won't say abalone.

In this lesson, 4-H members will be introduced to seafood, and learn the basic nutritional value of food from the sea.

What Your 4-H Members Will Learn

. to recognize seafood as a nutritious food source
. to associate various types of seafood with specific nutrients

Background Information

Seafood is a rich source of nutrients, easily digested protein, niacin, iodine and vitamins A and D. In addition most seafood is low in fat, which makes it an excellent food for weight conscious people. In addition to being good for you, seafood is tasty and sometimes lots of fun to cook and eat.

There are two basic types of seafood, shellfish (clams, oysters, scallops, crabs, lobster, and shrimp) and finfish (flounder, sole, halibut, perch, tuna, swordfish, and herring, just to name a few. There are at least 200 varieties available in the United States.

You are probably aware of the "fish sandwich" served in many fast-food restaurants and school cafeterias. But seafood has a lot more variety, there are lots of ways to cook and eat tasty treats from the sea.

Preparing For The Meeting

Review the background information. It is very simple and only serves as an introduction to seafood. Read over the activity below. This is designed to familiarize members with types of nutrients. You may also want to use the activity sheet "Fishing For Food Value" to help members associate types of seafood with specific nutrients.

In addition to the information provided you may want to check out a seafood cookbook for additional information and some good recipes. Start simple and mild, beginning with familiar varieties to help members develop a taste for seafood.

Involving The 4-H Members

Discuss various types of seafood. Using the activity sheet identify each type of seafood. Have you eaten these foods? Have any of the 4-H members been fishing? What did you catch? Did you eat the catch? The activity sheet can also be used as a coloring sheet for members.

Activity I - Nutrient Charades

The purpose of this activity is to help 4-H members learn to associate various nutrients with their function.

Materials needed:

. nutrient charade strips

This activity may be done by members individually or in teams.

You may transfer the information below onto 3 X 5 index cards or copy and cut apart the individual strips.

Distribute the strips to 5 members or various teams. Allow about five minutes for 4-H members to decide how to pantomine or "act out" nutrient function. Each of "actors" or teams will proceed to the front the group to perform nonverbally while other 4-H members/teams guess which nutrient is being described. Continue until all five nutrients have been used.

PROTEIN: I build strong muscles and help to keep your hair shiney and healthy.

NIACIN: I help to build and repair nerve cells and tissues. I also aid in digestion by helping the body use some nutrients for energy.

VITAMIN A: I help you see better at night and also keep your skin smooth and healthy.

VITAMIN D: I am needed for your body to use calcium and phosphorus to build strong bones and teeth. Another name for me is the "Sunshine Vitamin."

IODINE: I am a mineral which helps regulate the thyroid gland and prevent goiters (growths on the neck).

After completing the charades, refer to the activity sheet and associate the nutrients with types of seafood.

To introduce seafood, you may want to prepare one of the following snacks as refreshments at this meeting or you may plan to have the 4-H members prepare one of the snacks at the next meeting.

SHRIMP MINI PIZZAS

3 cans (4 1/2 ozs. each) shrimp
1/3 cup chopped onion
3 cloves garlic, finely chopped
1/2 cup oil
3 cans (6 ozs. each) pizza sauce
1 1/2 teaspoons oregano
2 packages refrigerator rolls
3/4 pound mozzarella cheese

Drain shrimp and rinse with cold water. Cook onion and garlic in oil until tender. Add pizza sauce and simmer for 5 minutes. Remove from heat. Open and separate refrigerator rolls. Place individual rolls on cookie sheet, using your fingertips flatten out individual rolls to resemble mini pizza crusts. Cover each mini pizza with a few teaspoons of sauce, a few shrimp, and pinches of mozzarella cheese. Shake oregano on top of cheese.

Bake in a hot oven 425°F for 10 minutes or until cheese melts and crusts are slightly browned. Makes 20 mini pizzas.

TUNA TREATS

1 cup canned tuna
Flake it with a fork. Add:
1/2 to 1 cup diced celery or cucumber
Make a dressing using:
2 tablespoons olive oil
2 tablespoons lemon juice
or use:
1/4 cup mayonnaise
Add:
1 tablespoon chopped onion
1 tablespoon chopped parsley

Mix thoroughly.

Spoon tuna salad onto snack crackers. Top each cracker and tuna with a few pieces of shredded cheddar or American cheese. Place crackers on a cookie sheet. Put into oven under the broiler until cheese is melted and slightly browned.

TUNA APPLE SALAD

2 cans (6 1/2 or 7 ozs. each) tuna
2 cups diced apples
1/2 cup chopped celery
1/2 cup mayonnaise or salad dressing
1/4 cup raisins
1 tablespoon lemon juice
Lettuce as desired.

Drain tuna. Break tuna into large pieces. Combine all ingredients except lettuce. Chill thoroughly. Serve on lettuce.

Additional Resources and Ideas

There are many excellent seafood cookbooks featuring recipes for New Jersey seafood. A suggestion: From Catch To Kitchen or Catching and Cooking Your Own Fish Dinner by Susan Bonsall, New Jersey Marine Sciences Consortium and Rutgers, The State University. Available from New Jersey Sea Grant Program, Cook College, Rutgers University.

Also available are placemats featuring popular species of New Jersey fish. Just ask your 4-H agent.

References

Webb, Anita H.; Howlett, Sandra E.; and Kimmich, Anita E. **Seafood Products: An Instructional Guide For Home Economics Programs**. Sea Grant Extension Division. Blacksburg: Virginia Polytechnic Institute and State University.

U.S. Department of Commerce. National Oceanic and Atmospheric Administration. **Seafare From NOAA**. Washington, D.C.: U.S. Government Printing Office. 1980.

Rombauer, Irma S.; Becker, Marion Rombauer. **Joy of Cooking**. New York: Bobbs - Merrill Co. 1975.

A Carousel of Nutritious Salads Program Brochure. Cape May - Atlantic County Nutrition Education Program.

MORE MARINE ACTIVITIES

Introduction

The following section includes some additional fun and creative project ideas for you, the 4-H leader, to use to peak your member's enthusiasm and relate the marine world to other project areas and interests.

What Your 4-H Members Will Learn

- appreciation of arts and crafts related to the sea.
- members will gain understanding of the relationships of other activities to their marine science project.
- to participate in fun educational activities.

Background Information

Young people often need a variety of activities to maintain their interests and stimulate their learning. Some members also progress more rapidly than others and need new ideas. Often combining activities from various projects (i.e. photography, arts and crafts, etc.) will provide for members a link to their interests and expand their experiences.

Preparing For The Meeting

Review activities, gather your materials and have fun.

Involving Your 4-H Members

The activities in this section may be completed by individuals or in some cases by the entire club. Some of the projects are suitable when completed to be shared as a community service. For example, why not have your club make a set of "Fun Folders" and donate them to a day care center or the children's section of your local library?

Discuss with your members the following activities, get them involved and have them share their interests.

FUN FOLDERS

Materials:

- seashore or marine related paperback activity book (available at most grocery stores)
- 8 to 10 file folders
- clear contact plastic
- scissors
- construction paper
- rubber cement
- watercolor markers
- wipe-off markers or grease pencil for students
- facial tissue

Procedure:

Cut out one activity page for each fun folder and mount it on colored construction paper with rubber cement. Glue the construction paper to the right inside half of the file folder and cover the activity page with clear contact. Be sure to leave the center fold free.

Glue the answer to the left side of the file folder and cover it with a flap of construction paper.

Label the activity on the extended edge of the folder; leave the outside of the folder plain.

Store in an envelope or box that is easily accessible to members. An empty box, covered with colored contact, is ideal. Keep each set of fun folders separate.

Try to include different levels (easy to difficult) and different interest items, (math, reading, puzzles) in each set.

How To Play:

Choose the folders you want to do.

Use a wipe-off marker or grease pencil to fill in your answers.

Check your answers, then rub off your answers with a damp tissue and return the folder to its case when you are finished.

BLAH

Materials:

. 24 index cards
. Markers

Procedure:

Write questions or words related to marine science to be identified on 20 index cards.

Draw or paste magazine pictures on three cards.

Make one "blah" card, as ugly or startling as possible.

This game is so simple that it may not be necessary to laminate the cards.

How To Play:

Shuffle the cards and place them face down on a table.

Choose a player to be first. He or she selects the top card and answers the question or identifies the word. If correct, the player scores one point; if not, no points are scored. Play continues to the left.

A picture card is a free card and scores three points.

Whenever a player turns up the "blah" card, that player loses and the game is over. The player with the most points wins the game.

KNOT TYING

Materials:

- See Worksheet "Knot Tying" Appendix I.
- One piece of rope, three to four feet long, for each member.

Note:

This activity teaches the basic knots used by sailors, the function of each and the importance of each to survival.

The 4-H members should be able to master the square knot, bowline knot and clove hitch. They also should learn to distinguish between the square knot and granny knot and understand why the granny knot is unsafe.

MAKING A NET

Materials:

- heavy twine or cording
- 6 feet of rope for headline
- empty paper towel or toilet tissue roll

Note:

This is one of the more difficult activities. You may need practice tying the knots yourself before presenting this to the members.

Illustrations of the clove hitch and fisherman's netting knot are included in the Appendix I.

Because of the limitations of the twine, this activity will not result in a usable net. By adding more twine and rope and using a netting needle, an actual net can be produced.

Procedure:

Anchor both ends of the rope to a firm surface, leaving the center free and taut.

Begin with approximately 25 feet of twine. Tie the twine to the headline (rope) with clove hitches.

Loops can be made around the tissue roll to assure even loops. Make six or seven hitches.

Begin a second row of knots, moving in the opposite direction.

The fisherman's netting knot, also called the sheet bend, is made in succeeding rows of netting with each loop being pulled tight against the tissue roll to assure even net loops.

MATCH-UP CARD GAME

Materials:

- 12 to 20 index cards
- Marking pens
- Pictures and descriptions sized to fit cards
- Rubber cement

Procedure:

Separate the pictures and descriptions.

Glue one picture to a card and the description to another card. Make from six to 10 pairs.

Make an identifying color mark on the backs of each pair of cards, using a different color or mark for each pair.

This game can be made with sharks, sea vessels, marine occupations, etc.

How To Play:

If playing alone, lay all cards face up on the table. Try to match each picture to its description. Check the backs of the cards to see if you are right.

If two people play, take turns. If the player correctly matches a pair, he or she keeps the cards. The person with the most cards at the end of the game wins.

ISLAND OR BEACH MODEL

Materials:

- corrugated cardboard box or other heavy container
- saran or cellophane
- sawdust
- sand
- wheat paste (available at hardware stores) or white glue
- newspapers
- small twigs, bits of cloth
- construction paper
- pipe cleaners
- scissors
- shallow container for glue or paste
- pencils

Procedure:

Members need to be very familiar with the description of the island or beach they plan to make in miniature. This comes from careful reading of the selected book. Review books or pictures of beaches and islands.

Tear the newspapers into strips in advance. Reserve some newspapers to use as protection for table or floor.

If using wheat paste, thin according to the manufacturer's directions. White glue should be thinned half and half with water.

After deciding what type of model will be built, make preliminary sketches on the bottom of the cardboard box or container.

Dip strips of newspaper into paste or glue solution and begin to build the island or beach according to the contours described in the book.

For finishing touches, sand and sawdust will stick to the damp papier-mache to represent sand and earth. Saran or cellophane crumpled over blue construction paper becomes the sea. Pipe cleaners with green construction paper leaves become palm trees.

SEASHELL COMPUTER

Materials:

- 15" X 18" posterboard
- two pieces of posterboard in a second color cut into 9" diameter circles
- colored markers
- shell pictures (eight or nine)
- two brads
- scissors
- rubber cement

Procedure:

Cut openings near the edge of each posterboard circle; one opening should be a 1/2" X 2" rectangle, the other should be a 2" X 2" square.

Attach each circle to the large posterboard with a brad so that the circles extend from the sides of the "computer".

Glue the shell pictures in equal segments on the large posterboard so one is exposed when the 2" X 2" opening is over the picture. Randomly write the names of the shells beneath the other circle so one is visible when the rectangular opening is over the name.

Match the shells with their names. As each pair is matched, give each an identifying mark (or color) at the top of the circle. Draw an arrow on the large posterboard pointing to the identifying mark.

Repeat the identification until each shell is matched.

Each pair will be matched when its color is under the arrow marker.

Decorate the posterboard to look like a computer.

Laminate each piece separately.

How To Use Your Computer:

Spin the circle of shells.

Turn the circle of names to match the color of the arrow to learn the name of each shell.

SHELL WHEELS

Materials:

- posterboard cut into 9" or 10" diameter circle
- eight small seashells or pictures of shells
- eight clip-on type clothespins
- scissors
- permanent markers
- fine-line permanent marker
- ruler

Procedure:

Using a ruler or straight-edge, divide the circle into eight pie-shaped parts with the fine-line marker.

Glue a shell near the center of each part, leaving the border to clip on the clothespins.

Write the name of a shell on a clothespin with a fine-line marker.

Clip each clothespin to the posterboard adjacent to its matching shell. Turn the posterboard over (both pins and posterboard should be blank).

Using permanent markers, color a dot on the inside edge of each clothespin and match it to a dot on the posterboard. Use a different color for each set.

How To Use Your Shell Wheel:

Match each shell on the wheel with a name printed on a clothespin. Clip the pin to the wheel by its shell.

Turn the shell wheel over to check your answers. The colored dots should match.

SCRIMSHAW

Scrimshaw is the art of etching whale bone and ivory and other hard surfaced materials. The art is an ancient one with artifacts representing Egyptian, Mesopotamian and Babylonian cultures. The Chinese, Japanese and Eskimos produced many priceless examples of scrimshaw. The term scrimshaw was coined by 18th century sailors who probably learned the art from villagers at their ports of call. The designs and scenes depicted by sailors with scrimshaw ranged from seascapes to pictures of the "girl back home".

Today, the use of whale bone and ivory is controlled by national and international law. For the most part, authentic scrimshaw can only be found in museums.

Materials: (for 20 4-H'ers)

- 5 lbs. plaster of paris
- 1 box paper cupcake liners
- 1/2 gallon milk carton or small bucket
- stiring stick
- water
- 20 large paper clips
- paper towels
- tempera paint (dark color)
- paint brushes

Procedure:

Mix the plaster and water in the milk carton to form a paste. Do not make the plaster too thick. Avoid excessive stirring.

*Place 40 cupcake liners on a flat surface covered with newspaper. Pour or spoon the plaster into the liners to a depth of 1/2 inch.

Allow the plaster to harden then peel away the paper liners (2 cakes per student).

Students make etching tools by straightening one end of a paper clip.

Students can design their graphics on a piece of paper. Suggestions for pictures are starfish, fish, birds, boats, initials, name, etc. Draw the graphic on the plaster disc with a pencil. The graphic should cover the whole disc. Avoid small, complicated drawings as they do not etch well.

Students then etch the graphic into the plaster with the paper clip. The etchings should be clean and deep.

Paint the surface of the plaster with tempera paint working the paint into the etching. Do not apply a heavy coat of paint.

Lay paper toweling on a flat surface and rub the plaster across the paper towel with long, smooth strokes. Continue rubbing to lighten the surface of the plaster, but leaving the darker etched lines.

*A small paper clip can be inserted in the bottom of the cupcake liner to make a hanger. Also two ends of a short piece of string can be placed in the plaster before it hardens. The plaster scrimshaw can be used as ornaments, paper weights or wall decorations.

SOAP CARVING*

***Caution**: Be careful with knives. No horse play during this activity.

Materials:

- bar of soap and pocket knife for each member

Procedure:

Using clear pictures from reading books, plan and carve a sailing vessel from soap.

When finished, the ship will float on water. Some of the soap will dissolve, however, so you may wish to keep the carving for display purposes only.

The Craft of Sail - Illustrations lend themselves to this type of interpretation as students duplicate the drawings in soap.

The Eyes of the Amaryllis - The figurehead of the **Amaryllis** is a natural subject for soap carving. Reference books showing different kinds and styles of figureheads may be helpful.

Island of the Blue Dolphins - Although Karana did not have a carving compound to interpret her images of the world, it is possible for students to recreate her need for beauty in this media.

WOOD PAINTING

Materials:

- scrap lumber in various sizes or driftwood
- tempera paints
- white glue
- brushes

Procedure:

Mix two parts water and one part white glue with dry tempera to help the paint stick to wood and also to give it a slightly glossy finish.

Choose a piece of wood for your painting.

Plan your seascape painting.

Paint the seascape with the tempera and glue mixture.

PHOTOGRAPHY

Pictures of the marine environment are very beautiful, fun to take and can really capture the feeling of being at the shore.

Consult your 4-H agent for materials on photography, there are leader and member guides available.

Encourage your members to take pictures of the beach, birds, organisms, etc. when on a field trip.

Some ideas:

Start a photo album of shore or marine pictures.

Pick a favorite marine photo and have it blown up. You can mat it for display.

Take a series of shoreline pictures at different times or seasons.

MARINE APPRECIATION

The beach and shore areas are not only a valuable natural resource but a beautiful place to be. Whether you sunbathe, swim, boat, fish, etc., it is something to enjoy. Many books, paintings, etc. about the sea, legends, tales, and seachanties are available for you to enjoy.

Check your local library or museums for resources to enjoy the sea.

Plan a meeting to bring books and to look at pictures of the shore and other marine environments. While looking at the pictures listen to beach or ocean sounds.

GEOLOGY

New Jersey is a small State, yet its geology has great diversity: in its four natural regions or provinces are over sixty geologic formations, many of which contain several varieties of rocks or sediments.

For the 4-H geologist, New Jersey has fantastic collecting localities. A variety of marine fossils can be found in the Coastal Plain, while the shales and argillite of the Piedmont Province yield dinosaur tracks.

Crystals and gems can be recovered from the sands and clays of the south, as well as from the mineralized formations of the Piedmont (particularly the "trap rock" minerals of the Watchungs and Palisades), the pegmatite outcrops and mine dumps of the Highlands, and the unique zinc deposits of Franklin and Ogdensburg in the northernmost Ridge and Valley Province.

Economic geology would focus on the glass sands of the South, the historically significant bog iron ore of the coastal bogs and swamps, the widespread construction sand and gravel deposits, the brick and ceramic clays of the Sayerville-Woodbridge area, the "trap rock" of the Watchung and the Palisades, the historic copper mines and argillite and sandstone quarries, the Dover "iron belt", the limestone quarries and the Portland cement industry of the North, and, of course, the zinc mines at Franklin and Ogdensburg.

The 4-H geology project gives young people an opportunity to literally "dig" the geology of New Jersey and learn a little or a lot (depending on your interest) about our minerals, rocks, and fossils.

Contact your 4-H office for information on a geology project. There are leaders and member guides available from Ocean County Cooperative Extension office.

References:

Bagnall, Norma. "**Children's Literature:Passage to the Sea**. A guide for teachers. Texas A&M University, Sea Grant College Program, 1980.

Hoppe, Catherine and Carolyn Hampton, Editor. "**Coastal Livelihoods and Crafts**". Project Cape, Dare County, North Carolina, 1982.

Fox, Barry W. **Scrimshaw Activity**. Extension Specialist. Virginia Sea Grant Program, Virginia State University. 4-H Marine Education.

Carlson, Alfred. "**Dig New Jersey Geology**". Department of 4-H Youth Development. Ocean County, New Jersey.

Appendix I

4-H Member Activity Sheets

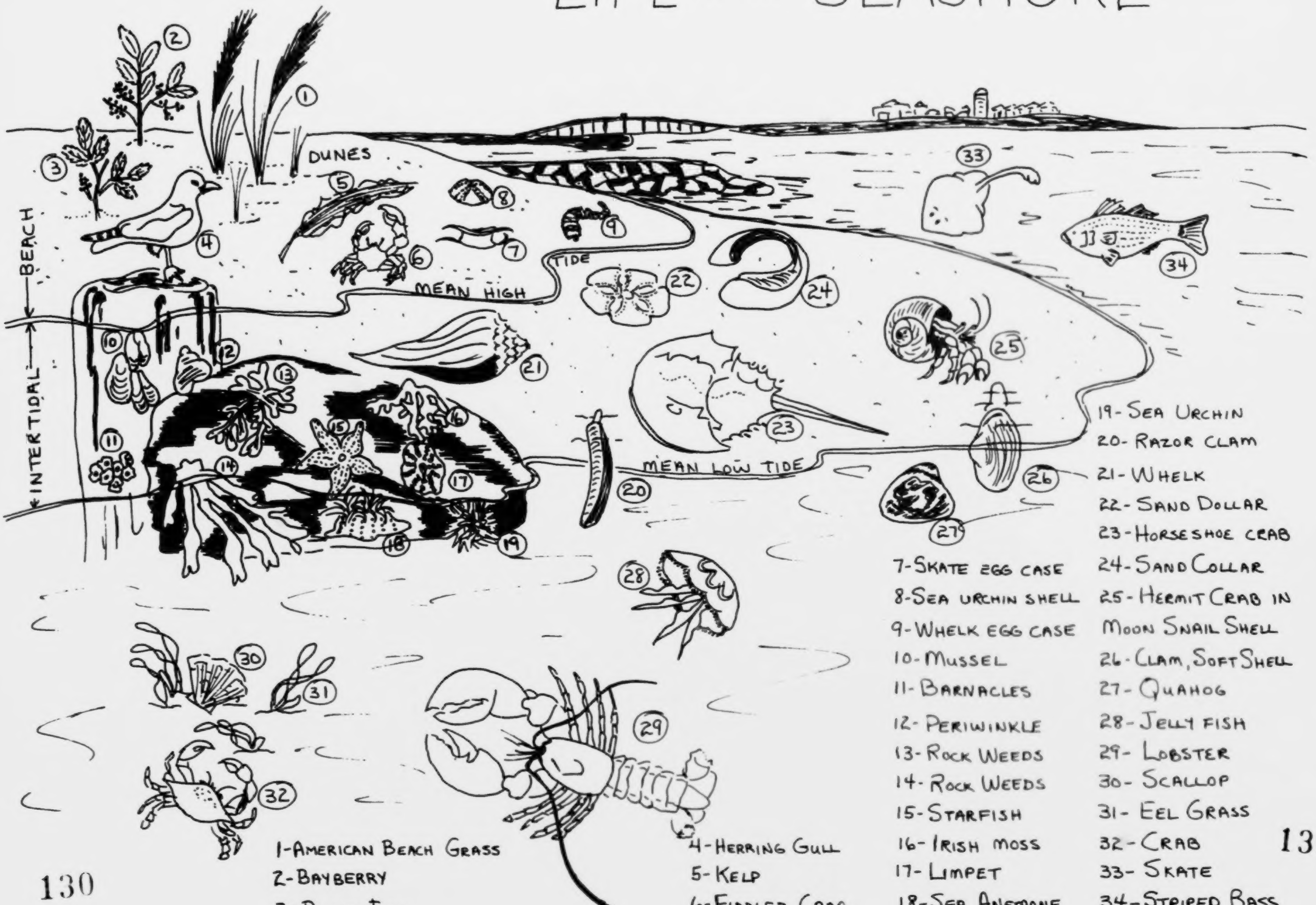
USING THE ACTIVITY WORKSHEETS

The following Worksheets are for use with the lessons included in this Project Leaders Guide. Throughout the lessons you will see references for use of these worksheets. They are just suggestions. Many of the worksheets apply to more than one of the lessons or activities contained in this booklet, however, you may use these worksheets wherever you feel that they fit in. I suggest that you not remove these master copies from the booklet but instead contact the 4-H professional in your county to make necessary copies.

In addition to those referenced in the lessons, we have included a few extras to be used at any time. Review the entire Appendix before making your selections.

ZONATION CHART

LIFE AT THE SEASHORE


DUNES
BEACH
INTERTIDAL
MEAN HIGH TIDE
MEAN LOW TIDE
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1-American Beach Grass
2-Bayberry
3-Poison Ivy
4-Herring Gull
5-Kelp
6-Fiddler Crab
7-Skate egg case
8-Sea urchin shell
9-Whelk egg case
10-Mussel
11-Barnacles
12-Periwinkle
13-Rock Weeds
14-Rock Weeds
15-Starfish
16-Irish moss
17-Limpet
18-Sea Anemone
19-Sea Urchin
20-Razor clam
21-Whelk
22-Sand Dollar
23-Horseshoe crab
24-Sand Collar
25-Hermit Crab in Moon Snail Shell
26-Clam, Soft Shell
27-Quahog
28-Jelly fish
29-Lobster
30-Scallop
31-Eel Grass
32-Crab
33-Skate
34-Striped Bass

Illustrated by K. Ostrander

EXPLORING BEACH SAND

Introduction

The purpose of this activity is to learn about sand. You will learn what it is like and what it will do.

If there is a space for an answer, write down your findings. If not just follow directions and think about what you are doing.

Sand is all around us. In the bare patches in the schoolyard you can see it mixed with dirt to make soil. On a windy day you can sometimes see it being blown along with the wind. You may have played in a sandbox at some time. If you have ever been to the beach, you have seen a great deal of sand. It is this beach sand that we are going to talk about. Beach sand has some things in it that other sand does not have.

All sand is made up largely of the mineral quartz. In addition, beach sand contains shell and shell fragments. The sand along the Jersey shore varies from north to south in content, color and texture. Northern areas have a coarser darker texture than sand along the southern shores. All of these things affect the color of the beach sand.

The sand on New Jersey's beaches came from the mountains of the northeastern states. It was originally rocks that have been broken up into tiny pieces by the actions of the wind and water. Rivers and streams then carried the sand to the ocean, and then it was carried to this area by longshore currents.

Materials needed:

- Beach sand (if beach sand is not available, builder's sand may be substituted)
- A sheet of paper
- A hand lens or magnifying glass
- A magnet
- A quart jar and lid
- A little oil (dirty crankcase oil will be excellent)
- A small bowl

The purpose of this project is to find out about sand-what it is like, and what it will do. Where a place is left for you to write an answer, do so. Otherwise, just follow the directions and think about what you are doing.

1. Look at your sample of sand. What color is it?
   Why?
   Do you think it has shell fragments in it?

2. Some heavy minerals, especially those with iron in them, will be attracted by a magnet. Put a magnet in contact with the sand. Are the grains attracted to it?
   Do you think your sand sample has any heavy minerals in it?

3. Pour a little of the sand onto a sheet of paper. Look at the grains through a magnifying glass or hand held lens. Do all the grains look the same?

Shell fragments tend to be more rounded and less jagged-looking. Can you find one?
If so, draw a picture of it.

Draw a picture of a sand grain.

4. Pour a little sand into your hand. Describe what it feels like.

5. Put about an inch of sand in the jar, then fill it almost full with water. Put the lid on. Tip the jar. What does the sand do?

Shake the jar. Does the sand settle back to the bottom immediately? The water in the oceans is constantly moving. Waves strike the beach endlessly, one after another. What effect do you think this constant movement of water might have on the sand that is under the water?

6. Put some dry sand in a bowl. Gently, blow on it. Can you blow some of the sand grains around?
A breeze blows almost constantly at the beach. What effect do you think this might have on the sand of the beach?

7. What other ways can you think of to experiment with sand?

BEACHCOMBING WORKSHEET

SPECIMEN DECRIPTION	NAME	NUMBER FOUND	ENVIRONMENTAL CONDITIONS

"USING A TIDE TABLE"

Introduction: Tide tables provide a summary of daily tidal information for specific locations along the coast. These tables vary in complexity from "pocket" guides that may be carried by sport fishermen to 300 page Continental Tide Tables that are necessary for ocean going freighters.

The information included on tide tables are the predicted times and possible range or water levels of the tides for a specific location. Because predicted tides are based on observations during average weather conditions, extreme weather patterns such as severe winds or high and low barometric readings will affect the actual tidal times and range. Therefore, the actual tidal levels may be above or below the table's predicted value.

Using A "Pocket" Tide Table: Below is an example of the information that is included on most "pocket" tide tables that you can obtain from your local marinas or bait and tackle shops. It is designed to provide ready access to the tidal information that fishermen may need for the local fishing area. This format also allows you to carry a tide table that will provide most of the information you need to plan and enjoy your fishing and upcoming activities in your 4-H marine sciences studies.

Tide Table for Atlantic Ocean
(Island Beach Park to Manasquan Inlet)

JULY

Day Light Savings Time

	A.M.		P.M.	
Date	**HIGH**	**LOW**	**HIGH**	**LOW**
1	3.32	9.39	4.06	10.30
2	4.28	10.25	4.59	10.76
3	5.20	11.09	5.46	11.63
4	6.10	11.54	6.27	
5	6.55	12.53	7.08	12.39
6	7.37	1.37	7.46	1.25
7	8.17	2.21	8.23	2.09
8	8.57	2.59	8.59	2.48
9	9.36	3.36	9.37	3.27
10	10.18	4.13	10.18	4.05
11	11.02	4.46	11.00	4.45
12	11.47	5.22	11.48	5.32
13		6.03	12.35	6.28
14	12.38	6.54	1.25	7.39
15	1.34	7.53	2.23	8.47
16	2.36	8.54	3.26	9.53
17	3.46	9.56	4.31	10.53
18	4.56	10.56	5.33	11.52
19	6.02	11.54	6.29	
20	6.58	12.50	7.22	12.54
21	7.52	1.45	8.12	1.52
22	8.43	2.37	9.01	2.45
23	9.35	3.25	9.52	3.36
24	10.26	4.10	10.42	4.26
25	11.14	4.55	11.30	5.13
26		5.37	12.03	6.04
27	12.17	6.22	12.49	6.59
28	1.03	7.12	1.37	8.00
29	1.52	8.03	2.26	8.59
30	2.45	8.55	3.20	9.53
31	3.45	9.47	4.16	10.45

AUGUST

Day Light Savings Time

	A.M.		P.M.	
Date	**HIGH**	**LOW**	**HIGH**	**LOW**
1	4.46	10.36	5.09	11.33
2	5.41	11.25	6.00	
3	6.31	12.23	6.43	12.13
4	7.14	1.09	7.24	1.01
5	7.55	1.53	8.01	1.47
6	8.32	2.33	8.39	2.29
7	9.12	3.09	9.17	3.09
8	9.51	3.44	9.56	3.49
9	10.33	4.18	10.38	4.29
10	11.19	4.52	11.24	5.15
11		5.31	12.06	6.09
12	12.15	6.20	1.00	7.17
13	1.13	7.22	1.59	8.30
14	2.17	8.33	3.05	9.39
15	3.33	9.42	4.14	10.41
16	4.48	10.46	5.20	11.40
17	5.54	11.46	6.19	
18	6.49	12.35	7.20	12.45
19	7.38	1.28	7.57	1.40
20	8.24	2.15	8.42	2.30
21	9.09	2.59	9.28	3.16
22	9.54	3.41	10.10	4.02
23	10.37	4.20	10.55	4.44
24	11.22	4.57	11.37	5.29
25		5.35	12.04	6.16
26	12.12	6.20	12.49	7.11
27	1.09	7.09	1.37	8.12
28	2.02	8.09	2.29	9.15
29	3.03	9.08	3.31	10.11
30	4.21	10.06	4.33	11.02
31	5.12	10.59	5.28	11.52

Tidal Conversions

SANDY HOOK

HIGH + 34 min...........LOW + 42 min.

ATLANTIC CITY

HIGH + 7 min............LOW + 7 min.

WILDWOOD

HIGH + 18 min..........LOW + 25 min.

MOON PHASES

JULY

Moon	Day
New Moon	6
First Quarter	14
Full Moon	21
Last Quarter	28
Apogee	4, 31
Perigee	19

AUGUST

Moon	Day
New Moon	5
First Quarter	14
Full Moon	19
Last Quarter	27
Perigee	16
Apogee	28

Source: New Jersey Sea Grant Extension Service - 1986 Tide Guide

"Using A Tide Table"

Parts Of A Tide Table:

1. Tides for each day are presented by month.
2. Adjustments are corrections that need to be applied to the table for other locations in the general area of the tide table location.
3. Nationally tidal times are expressed as Eastern Standard Time but many local tables provide Day Light Savings Time during Summer months. A good tide table should state it's time reference.
4. Daily tides in this table are semidiurnal (two highs and two lows occurring daily) but other areas may have diurnal tides (only one high and one low).
5. Note that because tides occur about 50 minutes later each day, tides that occur near the end of one day may skip a tide and have it occur early the next day.
6. This table does not give the predicted water levels at high and low tides but it does provide the Moon Phases to help you estimate the extremes of tidal range. Spring tides would occur near the new or full moon while heap tides will occur at the first and last quarter.

Use The Tide Table To Answer The Following Questions:

1. How much time lapse between each tide on August 12-13, 1986? Write your answer in the spaces provided.

AM/High	12:15	AM/Low	6:20	PM/High	1:00	PM/Low	7:17
AM/Low	6:20 ______	PM/High	1:00 ______	PM/Low	7:17 ______	AM/High	1:13 ______

What is the total time for the complete tidal cycle? (Add the four tidal periods) ____________.

2. Note the first high tide for August 12, 13 and 14. They are 12:15, 1:13 and 2:17. How much later does this high tide occur each day?

12:15	1:13
1:13 ______	2:17 ______

Why?

3. Using conversion factors, calculate the time of high and low tides at Sandy Hook on August 12.

High	Low	High	Low
12:15	6:20	1:00	7:17
+ 34	+ 42	+ 34	+ 42

WAVE TYPES

Objective: To observe wave shapes and behavior, and identify them according to basic types identified by scientists.

Materials:
this worksheet
pencil
YOUR EYES!

Method:

1) Observe the incoming waves for several minutes.
2) Do all the waves approaching the beach look alike?______
3) If not, how are they different from each other?
4) If so, how are they alike?
5) Make a line drawing(s) of the type or types of wave you see:

________________________ ________________________ ________________________

6) Compare your drawing(s) to the drawings and descriptions on the Wave Type Chart. Identify yours as spilling, plunging, collapsing, or surging, and write the name in the blank below your drawing. IF your drawing does not look like any on the Wave Type Chart, choose a word which best describes the type(s) of wave you have observed.

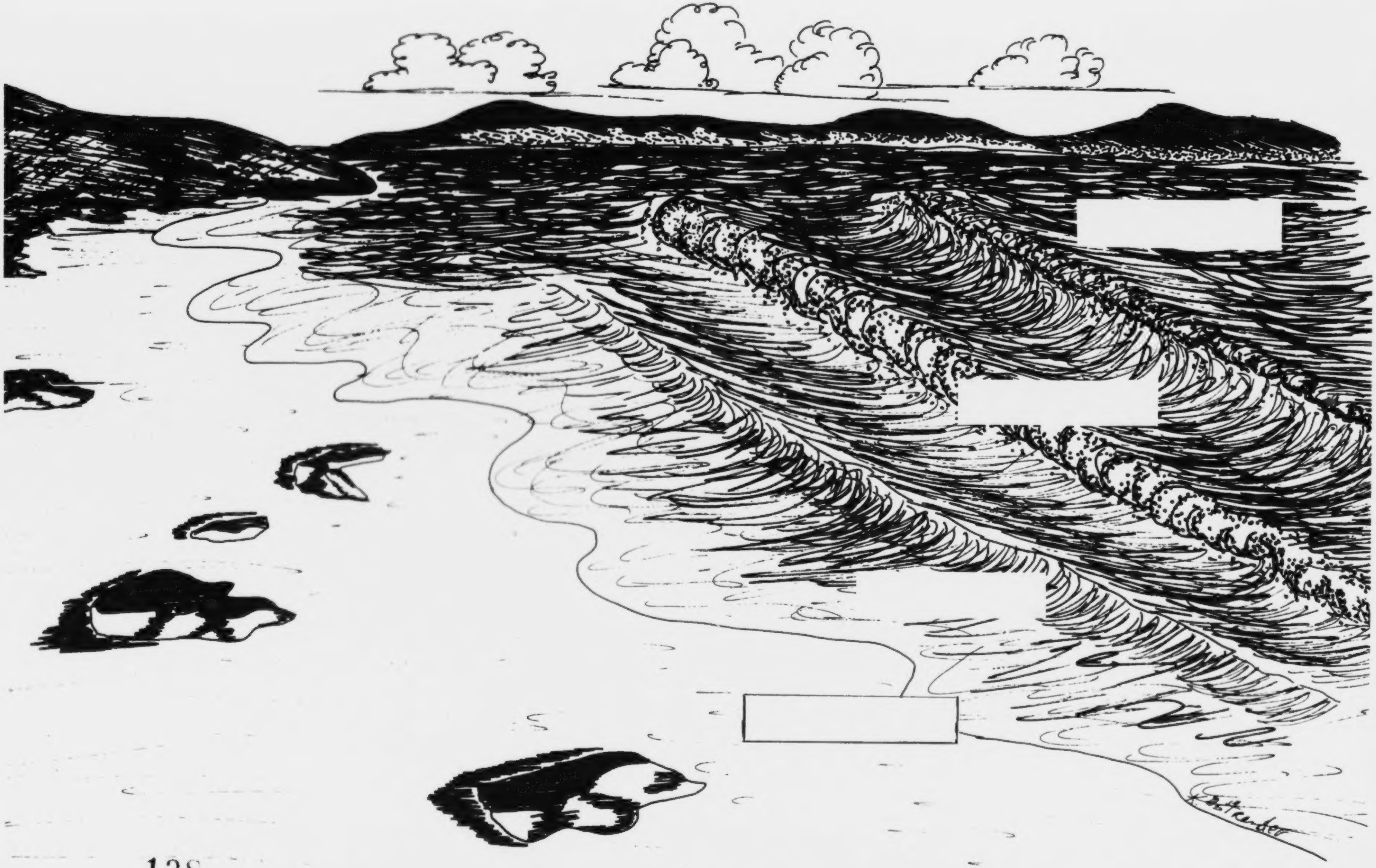
Types of Breakers

Breaker Type	Description	Beach Slope
Spilling	-Turbulent water and bubbles spill down front of wave	Flat
Plunging	-Crest curls over large air pocket; smooth splash up follows	Moderately Steep
Collapsing	-Breaking occurs over lower part of wave; small air pocket; no splash up; bubbles and foam	Steep
Surging	-Wave slides up and down beach; not much bubble or foam	Steep

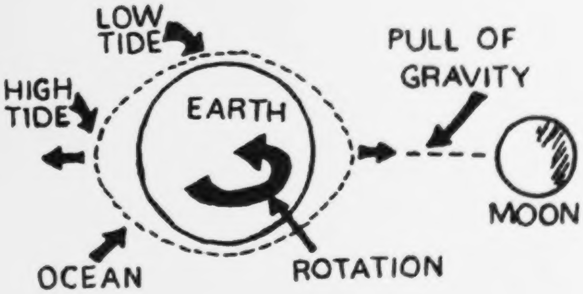
Identify each of the types of waves on the Types of Breakers Picture.

Reference: Gross, M. Grant. 1972. Oceanography A View Of The Earth. Prentice-Hall, Inc. New Jersey.

TYPES OF BREAKERS



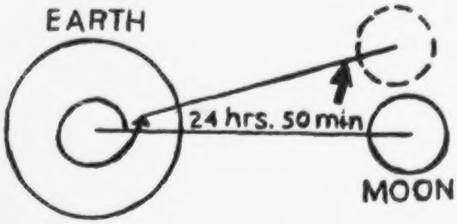
TIDES


LOW TIDE
PULL OF GRAVITY
HIGH TIDE
EARTH
MOON
OCEAN
ROTATION

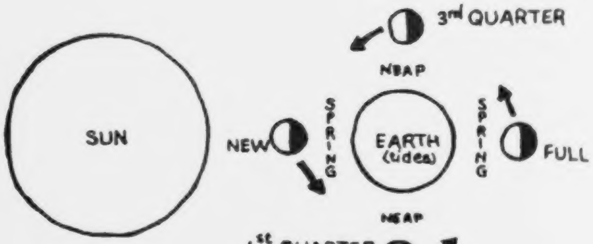
GRAVITY, CENTRIFUGAL FORCE AND TIDES

Notes:

Notes:


EARTH
24 hrs. 50 min
MOON

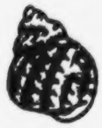
TIDES ARE 50 MINUTES LATER EACH DAY


3rd QUARTER
NEAP
SUN
NEW
SPRING
EARTH (tides)
SPRING
FULL
NEAP
1st QUARTER

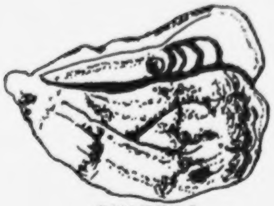
SPRING AND NEAP TIDES

Notes:

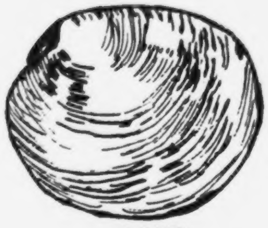
THE WETLANDS



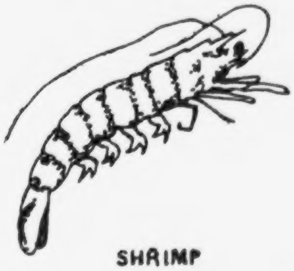
PERIWINKLES



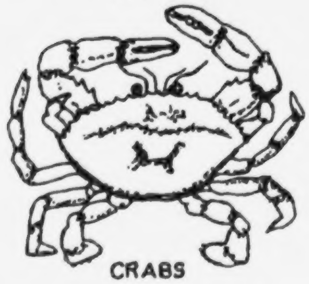
OYSTERS



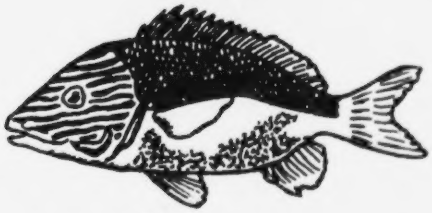
CLAMS



SHRIMP



CRABS



FISH

DRAW a picture of the **WETLANDS**:

DO YOU KNOW?...

1. How many acres of salt marsh are there in New Jersey?
   a) 7,000 b) 245,000 c) 756,000 d) 96,000

2. In Spring and Fall, the Jersey salt marshes are important resting and feeding places for thousands of migratory ...
   a) hawks b) geese c) monarch butterflies d) all of these

3. The dominant, most successful plants in the salty world of the wetlands are...
   a) cedar trees b) bayberry c) Spartinas or cord grasses d) seaweeds

4. Acre for acre, which type of environment is most productive?
   a) wheatfield b) saltmarsh c) coral reef d) open ocean

5. Many shellfish that live in the bays concentrate disease-causing bacteria from pollution in their flesh. Which doesn't?
   a) blue mussel b) oyster c) blue crab d) quahog

6. The earliest people to take advantage of a summer at the Jersey shore were...
   a) English settlers b) Leni Lenapi Indians c) Spanish explorers
   d) Colonial Philadelphians

7. When did the barrier islands, such as Cape May and Atlantic City first become popular as summer resorts?
   a) 1790-1810 b) 1750's c) 1890's d) 1920-1930

8. The salinity of seawater is generally about ...
   a) 42 parts of salt per 1000 parts water (ppt.) b) 8 ppt
   c) 24 ppt. d) 35 ppt.

ANSWERS

1) Although there are only 245,000 acres of salt marsh in New Jersey, less than 5% of the total land area, it is one of our most valuable natural ecosystems. In 1972 the state passed the Wetlands Act protecting salt marshes from unwise alteration or destruction.

2) The salt marsh is a year-round cafeteria for a diverse group of organisms. Particularly noticeable are the large concentrations of migrating geese and shorebirds. Herons, egrets, gulls and terns nest and feed on the marsh. Hawks migrate along the coast, resting and feeding on both the barrier islands and the marsh. In fall the southbound migration of the Monarch butterfly can be seen along the salt marsh border where they feed on seaside goldenrod.

3) Cordgrass is a plant well adapted to survive in the salty, twice-daily flooded world of the salt marsh. Special glands on its leaves give off excess salts from the plant and hollow tubes in the stems and leaves bring oxygen to the roots which are growing in the waterlogged mud of the marsh.

4) Because of the formation of detritus (finely divided, partially decayed plant material) salt marshes produce more usable material for the food chain than any other environment.

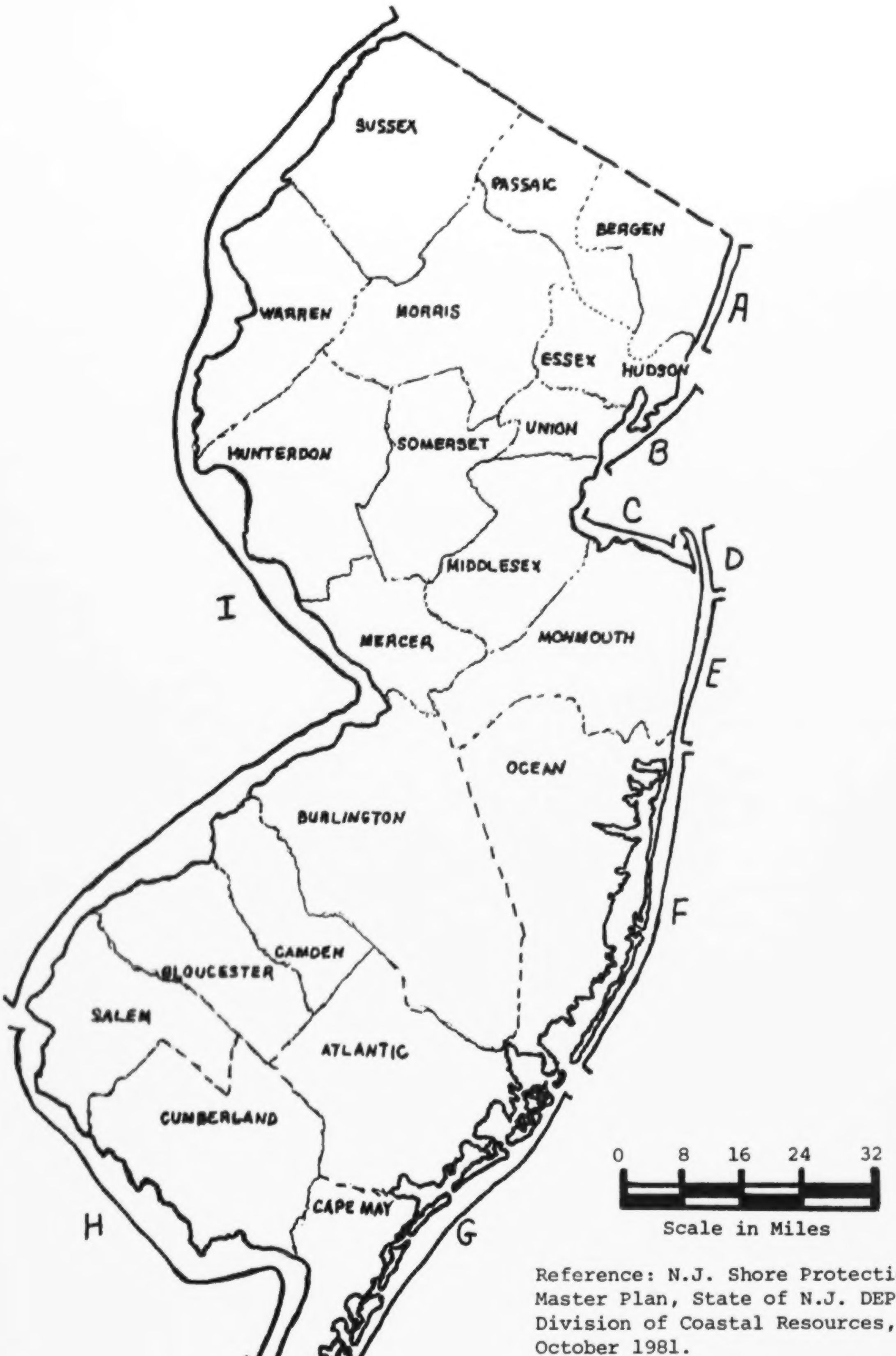
5) The blue crab does not feed by filtering food from the water. It does not concentrate disease-causing bacteria in its flesh. Filter-feeding mussels, oysters and clams can cleanse their flesh if moved to clean water.

6) The Leni-Lenapi Indians came to the shore each summer to harvest food from the salt marshes and ocean.

7) Cape May and Atlantic City were fashionable resorts as early as the late 1700's and early 1800's. People came to the shore to escape the heat.

8) Salinity is a measure of salt content. Ocean water has a salinity of 35 parts per thousand (35^{o}/oo) which means that each 1,000 grams of seawater contains 35 grams of dissolved salts. Sodium, chloride and sulphate together make up more than 93% of sea salt. Another 6% is magnesium, calcium, potassium. Sixty-six different elements make up less than 1%.

COASTAL WETLANDS OF NEW JERSEY


SUSSEX
PASSAIC
BERGEN
A
WARREN
MORRIS
ESSEX
HUDSON
UNION
B
HUNTERDON
SOMERSET
C
MIDDLESEX
D
I
MERCER
MONMOUTH
E
OCEAN
BURLINGTON
F
CAMDEN
GLOUCESTER
SALEM
ATLANTIC
CUMBERLAND
0
8
16
24
32
Scale in Miles
CAPE MAY
H
G

Reference: N.J. Shore Protection Master Plan, State of N.J. DEP, Division of Coastal Resources, October 1981.

COASTAL AREAS OF NEW JERSEY - DEFINITIONS

Using the coastal areas map, label with the letter which matches each description.

____ **DELAWARE BAY**
A large area of open water with a wide, open inlet to the ocean and with a major river flowing directly into its upper portion. The southern shore of the Bay is characterized by low bluffs fronted by a narrow strip of eroding coarse sandy beach. The northern section is an irregular low, eroding salt marsh coast with isolated small beaches backed by low dunes and firm ground.

____ **DELAWARE RIVER**
Forms the southwestern boundary of New Jersey. Tidally influenced to Trenton; important commercial shipping lane to Philadelphia. The main stem of the river begins at Hancock, New York, about 197 miles north of Trenton. From Trenton south, the river has been improved under Federal navigation projects. The river shore from Salem River to Trenton is highly developed and industrialized, with port commerce at Camden, Gloucester, and Paulsboro.

____ **NEWARK BAY AND HACKENSACK MEADOWLANDS**
In northeastern New Jersey; containing thousands of acres of uplands and phragmites marsh. The Hackensack River drains this area. Once considered desolate wasteland with extensive garbage dumps, it is now valuable industrial real estate. The Meadowlands Sports Complex and 2 major highways are found here. Development is regulated by the Hackensack Meadowlands Development Commission.

____ **NORTHERN BARRIER ISLANDS**
Consists of two long barrier elements; 1) south reaching Barnegat Barrier, which extends 21 miles from Bay Head to Barnegat Inlet, and 2) Long Beach Island, extending 20 miles south. The tidal lagoons or back bays behind are quite wide, ranging from 3 to 4 miles in most places.

____ **NORTHERN BARRIER SPIT**
Area referred to as Sandy Hook; extending 10 miles. A spit is a narrow strip of sand extending into bays or lagoons. Spits are connected to the coastline or to an island, and are formed by waves and currents piling up sand and sediment.

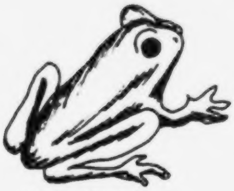
____ **NORTHERN HEADLANDS/BLUFFS**
Bluffs are steep shoreforms composed of softer erodible material such as clay, sand, or soft rock. Bluffs may be unstable because of the physical characteristics of the bluff material, seepage of groundwater in the bluff, and erosion of wave action at the base. The Northern Headlands area covering most of Monmouth County is characterized by narrow beaches at the base of subdued bluffs. This area extends from Monmouth Beach on the north through Long Branch, Asbury Park and Point Pleasant to Bay Head on the south.

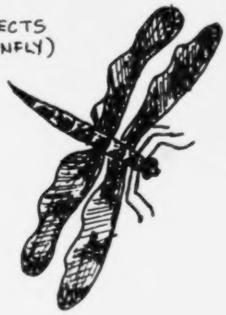
____ **PALISADE MOUNTAINS/CLIFFS**
Northern most section of the New Jersey coast. Composed of steep rock formations that erode very slowly if at all.

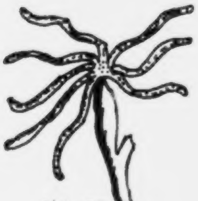
____ **RARITAN BAY**
The terrain along the shore between Perth Amboy and the Shrewsbury River ranges from high bluffs in the west and east to low marshlands. Beaches are low and narrow, and a number of tidal creeks intersect the shoreline. Much of the shoreline has been stabilized by structures such as bulkheads, groins and revetments. Some beaches are artificially filled.

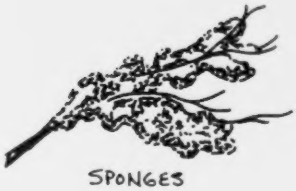
____ **SOUTHERN BARRIER ISLANDS**
A chain of smaller islands separated by seven inlets. The beaches are characterized by fine sand and have a flatter slope than northern beaches.

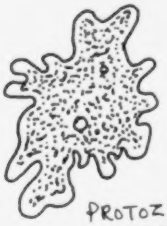
FRESHWATER HABITATS

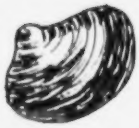

VERTEBRATES
(FROG)

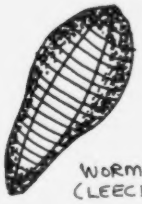
INSECTS
(DRAGONFLY)


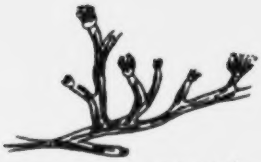

HYDRA


SPONGES


PROTOZOA
(AMOEBA)


MOLLUSKS
(CLAM)

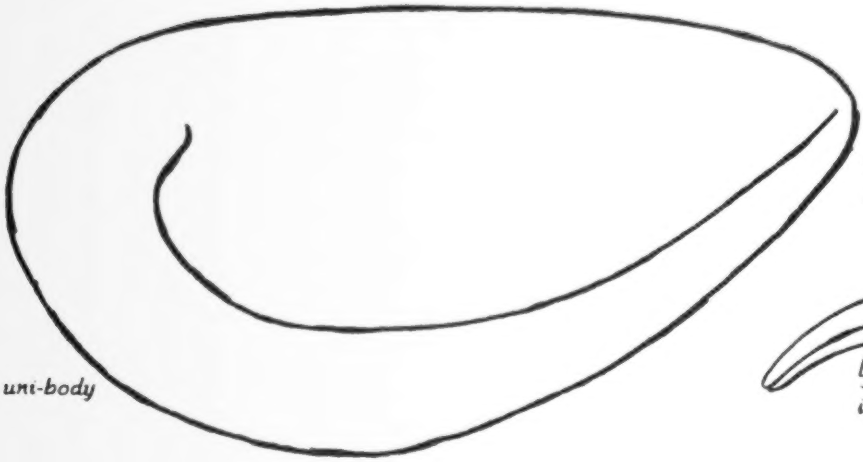

WORMS
(LEECH)


MOSS ANIMAL

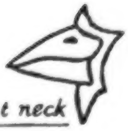
Draw a picture of the freshwater area. Include plants and animals found there.

Describe a pond.

BUILD A BIRD

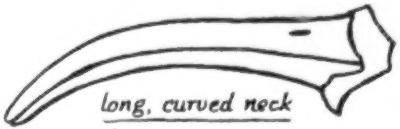


uni-body



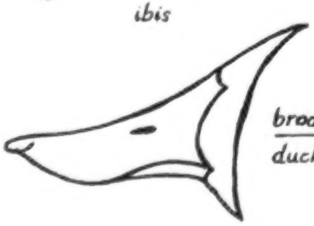
short, stout neck

songbird



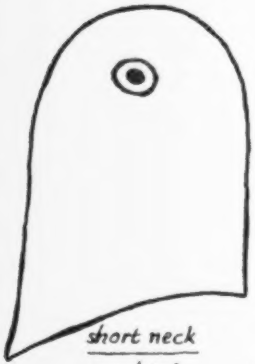
long, curved neck

ibis



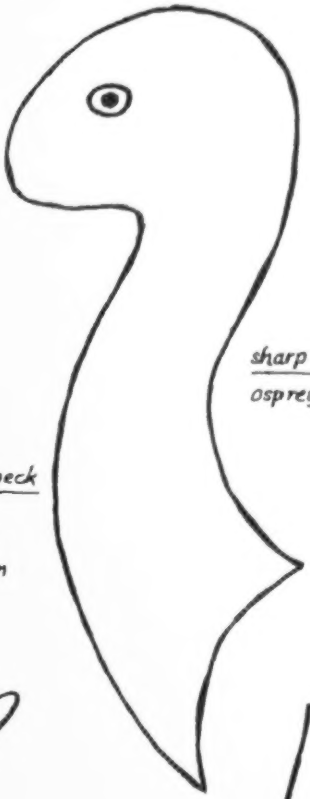
broad, flat bill

duck



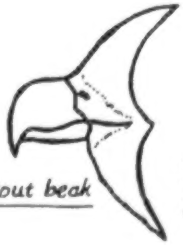
short neck

songbird
gull
osprey
duck



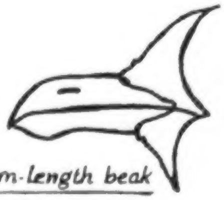
long neck

ibis
egret
pelican



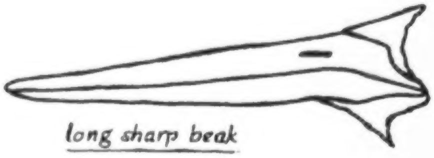
sharp stout beak

osprey



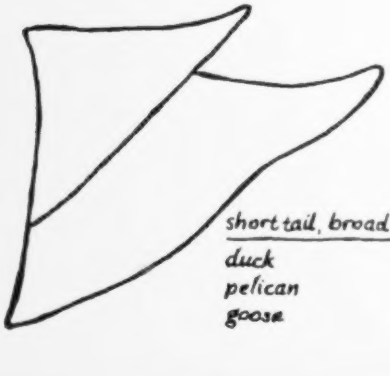
medium-length beak

gull



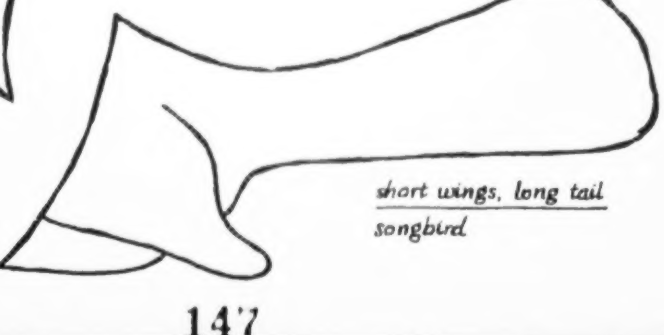
long sharp beak

egret



short tail, broad wings

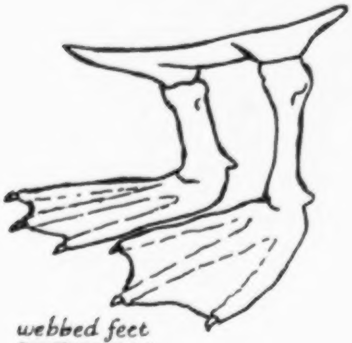
duck
pelican
goose



short wings, long tail

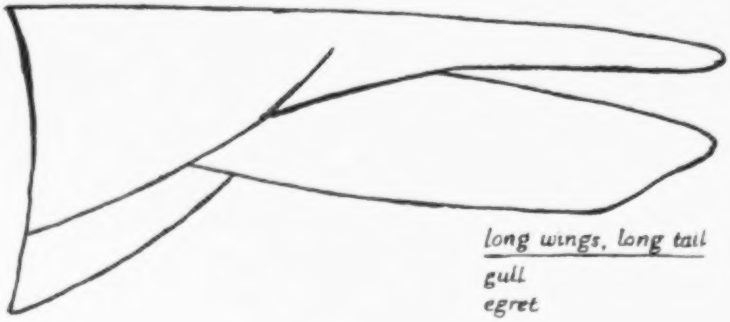
songbird

BUILD A BIRD



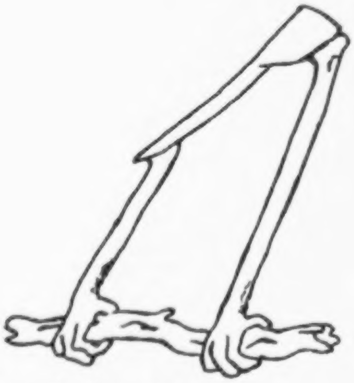
webbed feet

duck
gull
pelican



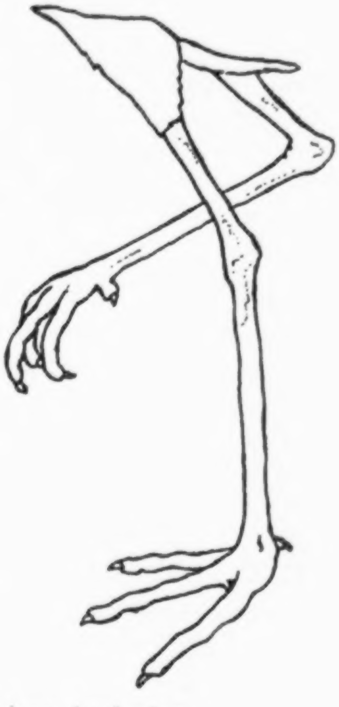
long wings, long tail

gull
egret



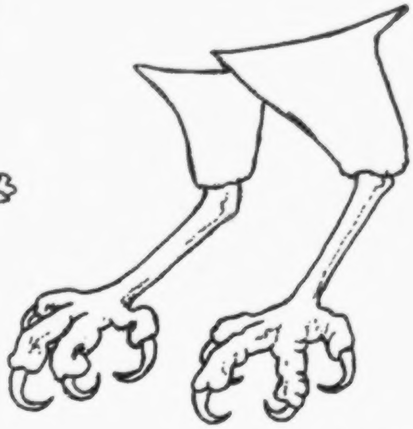
slender legs and toes

songbird



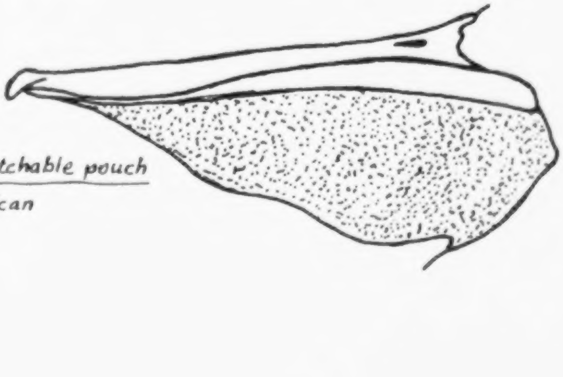
long slender legs

ibis
egret



sharp talons

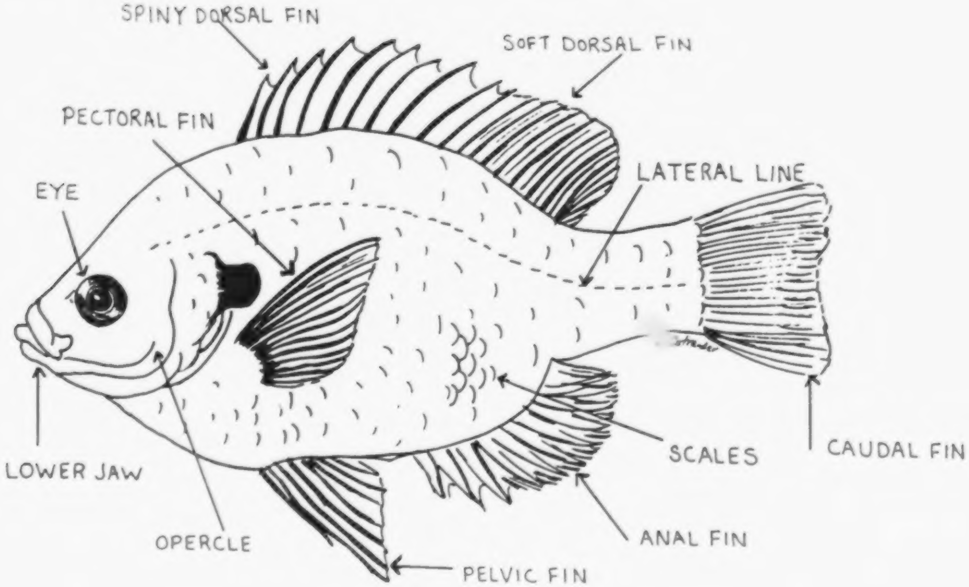
osprey

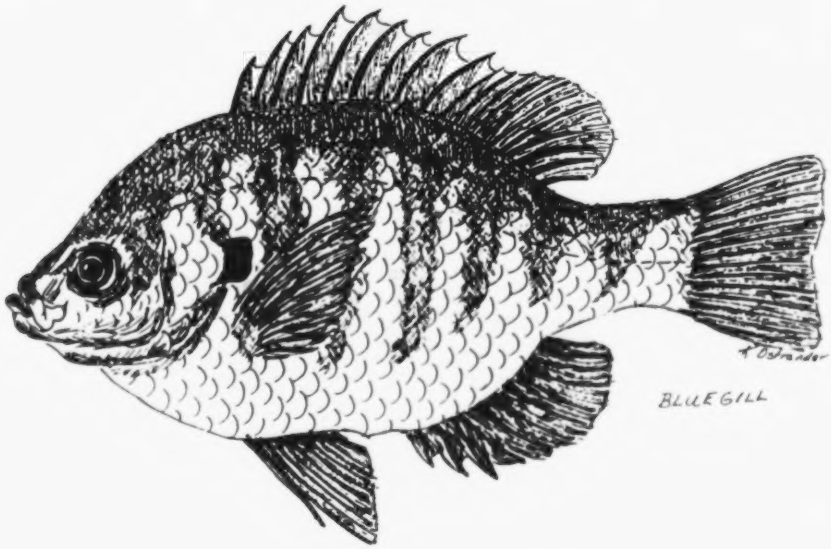


stretchable pouch

pelican

PARTS OF A FISH

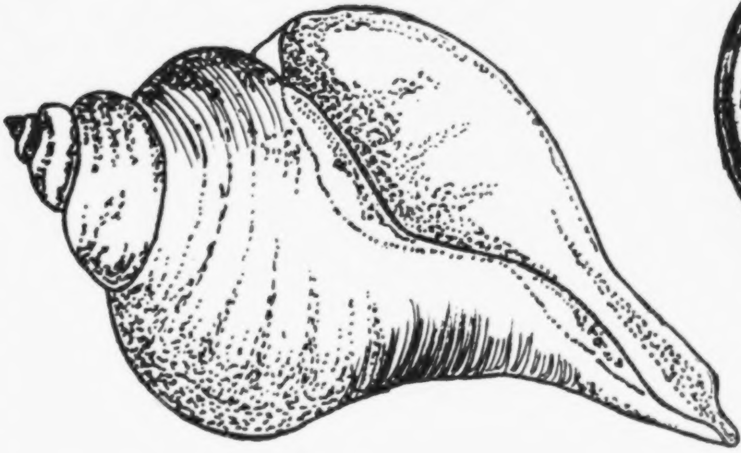

SPINY DORSAL FIN
SOFT DORSAL FIN
PECTORAL FIN
LATERAL LINE
EYE
LOWER JAW
OPERCLE
PELVIC FIN
ANAL FIN
SCALES
CAUDAL FIN



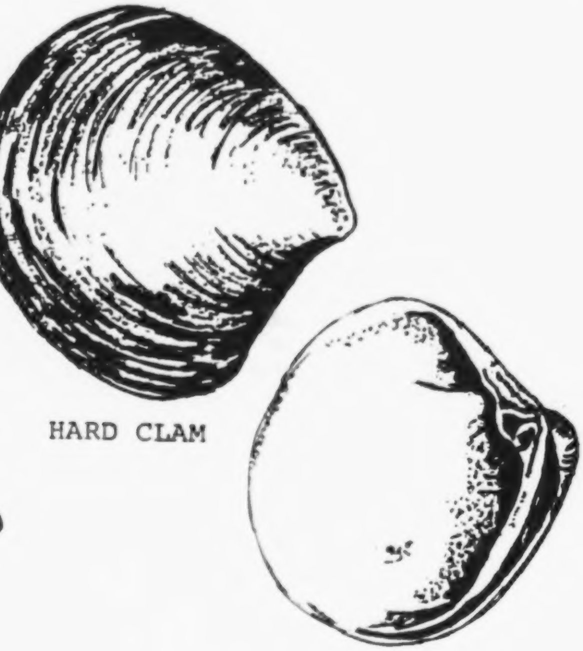
BLUEGILL

MOLLUSKS

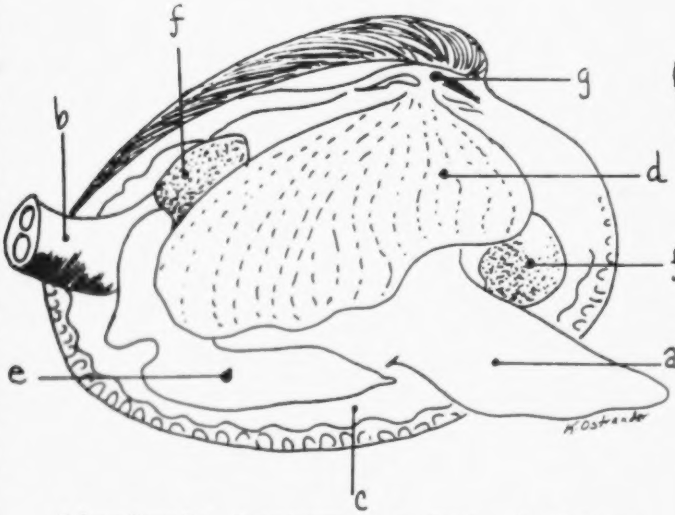
Compare the Univalve and the Bivalve. What are their differences? How are they alike?



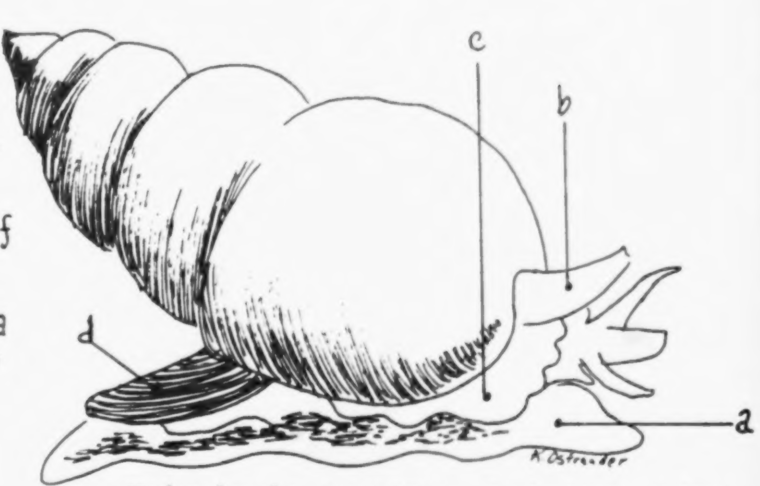
WHELK



HARD CLAM

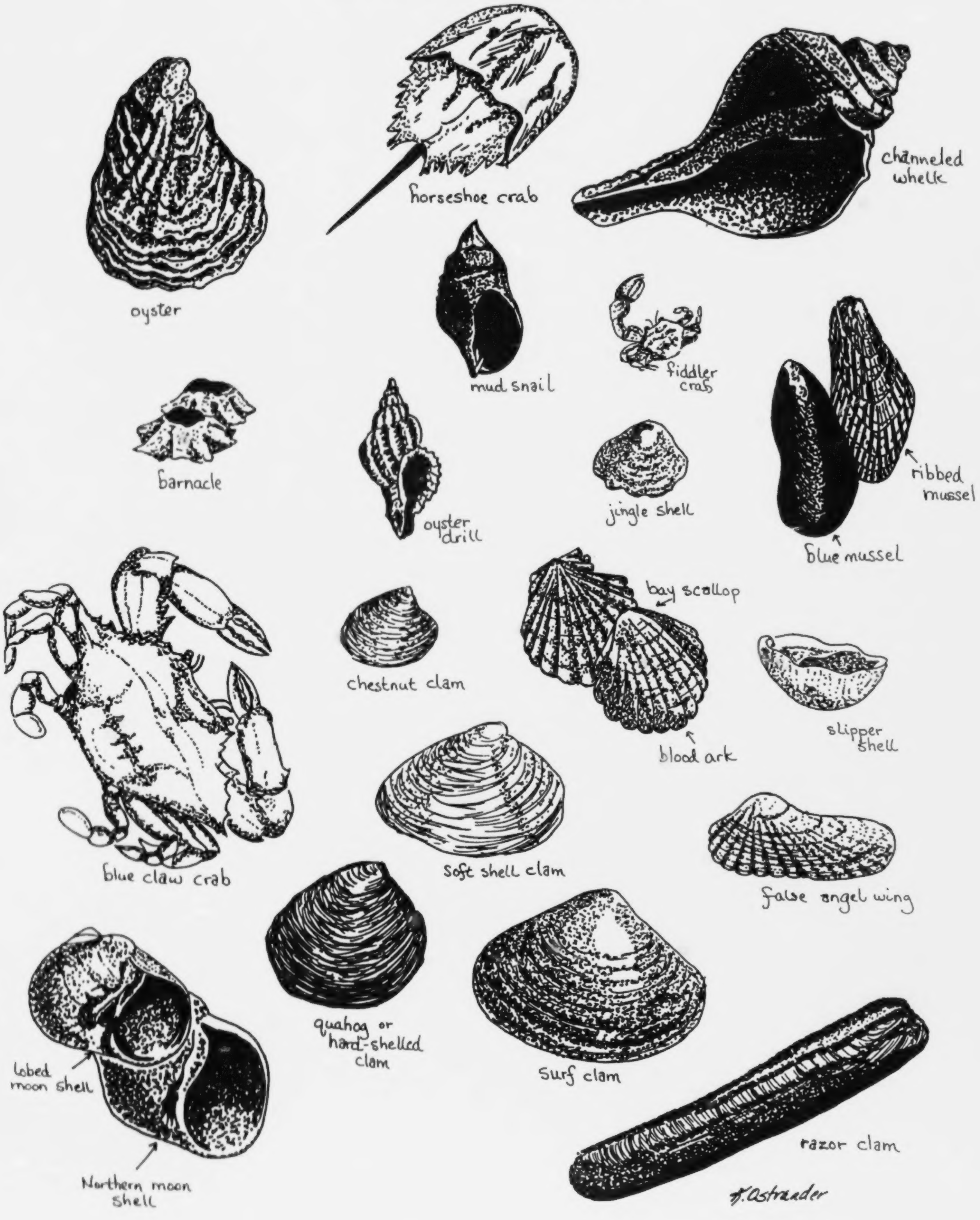

f
b
g
d
f
e
a
c
K. Ostrander

Bivalve's Anatomy: **a** foot, **b** siphon, **c** mantle, **d** gills, **e** stomach, **f** adductor muscles, **g** hinge. Oysters, clams, mussels all have them.


c
b
d
a
K. Ostrander

Univalve's anatomy: As before, **a** foot, **b** siphon, **c** mantle, but also **d** operculum. Univalves include whelks, winkles, conchs.

COMMON SHELLS OF NEW JERSEY


horseshoe crab
channeled whelk
oyster
mud snail
fiddler crab
barnacle
oyster drill
jingle shell
ribbed mussel
blue mussel
bay scallop
chestnut clam
blood ark
slipper shell
blue claw crab
soft shell clam
false angel wing
quahog or hard-shelled clam
surf clam
lobed moon shell
Northern moon shell
razor clam
J. Ostrander

COMMON SHELLS OF NEW JERSEY

SOFT-SHELL CLAM - This Soft-Shell Clam lives in shallow, muddy bottoms by Inlets. Known also as steamer clams, they are a tasty and popular food. The shell is dull, chalky white with unequal valves that do not close completely. Maximum size of the soft-shell clam is 3 inches.

SURF CLAM - The Surf Clam is the largest shell found on our beaches. It is the most abundant shell and lives in the sand in the surf zone to approximately 100 feet of water. The surf clam burrows a few inches into the sand, feeding on plant and animal life washed back and forth by the waves. This coarse white shell grows up to 7 inches.

QUAHOG - The Quahog, also called Little Necked, Hard-shelled or Cherry-stone, is probably the best known food source of the clams. Named by the Indians, the purple wampum was highly prized and served for food and trade. The quahog reaches approximately 5 inches.

CHESTNUT CLAM - The Chestnut Clams are a miniature version of the quahog but lacks the purple color. They live in shallow or moderately deep water and their tissues are of a red or orange color. These animals live in cooler waters and could grow to 1 inch.

RAZOR CLAM - The Razor Clam also known as the Jackknife Clam seldom survives the surf along the beach. This organism lives in muddy or sandy bottoms, growing to 7 inches. It is sweet and prized for its flavor.

FALSE ANGEL WING - The False Angel Wing is a clam that burrows in mud, clay, or peat. It lives about one foot below the surface and seldom grows more than 2 inches in length. Shells are thin, fragile and often pinkish in color. A real "Find" on the beach.

BAY SCALLOP - The Bay Scallop seldom reaches the size of 3 inches. The shell varies in color and is a collector's delight. This unique bivalve is mostly found in shallow waters and moves by closing its shell quickly creating a "Jet Propulsion".

BLOOD ARK - The Blood Ark is much thicker and does not have the two wings at the top of the shell like the bay scallop. The Blood Ark has red blood and may reach 2 inches when fully grown.

BLUE MUSSEL - The mussel is a black or blue colored shell. This organism usually grows in clusters attached to either a jetty or bulkhead. The mussel is an excellent source of food and will grow to 3 inches.

RIBBED MUSSEL - The Ribbed Mussel is similar to the Blue Mussel but has ribs and grows individually in the sandflats. Because it grows in a sandy environment, it is known to be very gritty but can be used as a food source.

BARNACLE - Barnacles do not look or act like other crustaceans. Eggs hatch into free swimming larvae, which feed and molt, change in form as they grow and feed by brushing plankton and organic matter with their feathery feet into their mouth. They attach to rock, shell, or ship hulls. Barnacles are a favorite food source of the Oyster Drill.

OYSTER - The Oyster is a long narrow shell that seems to be quite irregular. The Oyster shell could reach 10 inches in length. Although found on the ocean beach it also attaches to rocks, shells, pilings or any other hard object. The Lenape Indians used its shell to make cutting and scraping tools.

OYSTER DRILL - The Oyster Drill is a miniature species ranging from one half inch to 3 inches long and found on rocks and in tide pools. The oyster drill use a tongue-like file to drill a hole through bivalve shells and use a sucking tube to feed on the animal inside. They are the predators of Oysters, Barnacles and Mussels.

JINGLE SHELL - The smooth Jingle Shell is a one-inch shiny shell in either orange, silver or black. The shell anchors itself permanently to rocks, seaweeds or old shells by a fleshy appendage (Byssus) passing through the lower valve. Only the upper valve is washed ashore. The shell is occasionally called Mermaid's Toe Nail.

SLIPPER SHELL - Slipper Shells or boat shells are shallow water shells that are cup-shaped with a platform on the inside and attach to rocks or other shells. These shells reach approximately one and a half inches and change sexes. They are commonly called "Babies Bath Tubs".

MOON SNAILS - Moon Snails are found in sandy flats and spend most of their time digging through the sand in search of clams and smaller snails. They drill a neat hole through the shell of their prey and eat the meat. Their foot is large and covers much of the shell. The Lobed Moon Snail is similar to the Northern Moon Snail. The difference appears in the side opposite the spiral which has a lip, or lobe over the hole. Moon snails grow from 2 to 4 inches.

MUD-SNAILS - The Mud-Snail is a small species, one half to one inch in length and much more common than the larger and better known whelks. Mud snails may be seen by the thousands when mud flats are exposed at low tides. They are scavengers but also attack and eat bivalves.

CHANNELED WHELK - Whelks are the largest northern gastropods. The Channeled Whelk grows 5 to 7 inches and known to be edible. The animal drills bivalve shells with a rasping, tongue-like structure and feed on the animal within.

FIDDLER CRAB - The Fiddler Crabs are a burrowing crab, preferring the drier parts of sandy beaches and salt marshes. The Fiddler is named after the male's huge single claw but this claw is seldom used except in mating-season battles. These little crabs dig burrows up to 3 foot long and feed on organic material in the sand. The Fiddler Crab runs rapidly with a sidewise motion.

HORSESHOE CRAB - The Horseshoe or King Crabs are not crabs at all but may be descendants of ancient Eurypterids which existed some 400 million years ago. Their nearest living relatives are the spiders. These awkward animals are harmless. The female is larger than the male and lay her eggs in sand close to shore.

BLUE CLAW CRAB - Although the Blue Claw Crabs are known as scavengers of brackish water, they are one of our prized seafood delicacies. The Blue Crab lays her eggs in the summer and remain attached to her body. They hatch in about two weeks. The young crabs begin to molt and shed their shells as they grow and mature to adults in about one year.

PROTECT YOUR SALTWATER AQUARIUM FROM N.O.O.T.

Most fish in marine aquaria kept at home die from: **New Water**, **Overcrowding**, **Overfeeding**, and/or **Toxic Materials** (N.O.O.T.)

1. **NEW WATER.** If possible, about 25% of the water in a new tank should come from an aquarium which has held healthy fishes for at least a month. If you have no source of clean, aged water then fill the tank with new artifical seawater and allow it to stand for three days with filters running. A **small** piece of oyster or shrimp whould be placed in the aquarium during this time, but no fish. Fish may be added slowly after this adjustment period, which has allowed beneficial bacteria to multiply in the tank. Only one or two fishes should be added during the first week, and it is wise to make sure they are healthy before adding more.

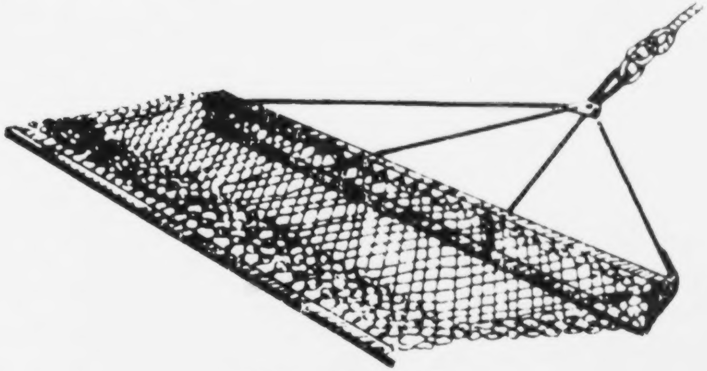
2. **OVERCROWDING.** Trying to see how many animals you can keep in a tank is asking for trouble. In general, the **larger** the aquarium and **fewer** animals, the better. Marine organisms need water for oxygen and waste disposal requirements, and when they are crowded any change in aquarium conditions can be deadly. More water per animal allows for more mistakes and less chance of disaster.

3. **OVERFEEDING.** Your animals won't die from eating too much, but decaying food left in the aquarium will quickly foul the water and eventually kill marine pets. The only thing left alive will be millions of bacteria which will produce a terrible odor and very cloudy water. Dead animals should also be removed promptly, since a decaying carcass can cause the same problems.

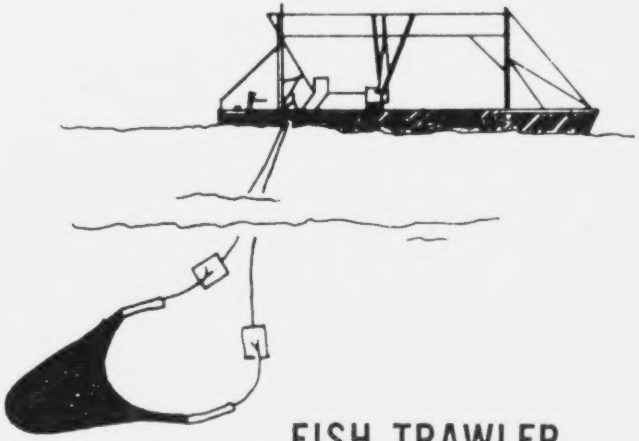
4. **TOXIC MATERIALS.** Be very careful about what you put into your tank: **clean** shells are fine, but not metals or some plastics. Follow the rule of adding **nothing** to your tank unless you are sure it is safe. Even stainless steel aquarium frames can cause problems unless coated to protect them from contact with the salt water.

Reference: James A. Lanier III, Fred C. Biggs. Virginia Institute of Marine Science Department of Information and Education. Gloucester Point, Virginia 23062. Educational Series #18.

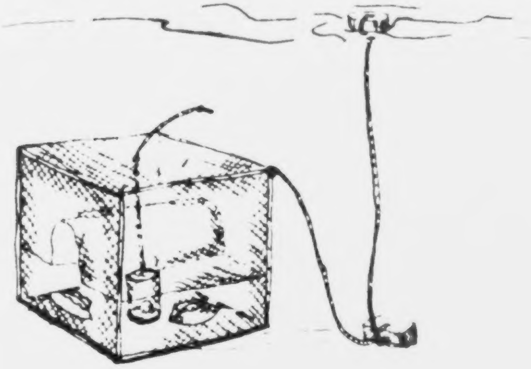
TOOLS OF THE TRADE



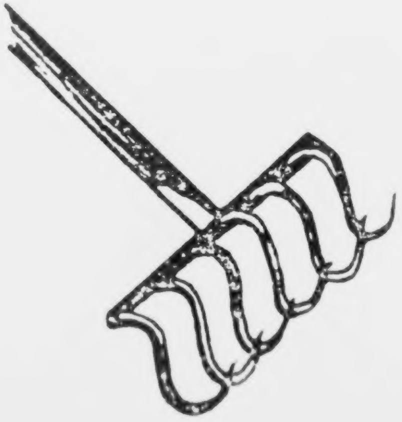
BAR DREDGE



FISH TRAWLER

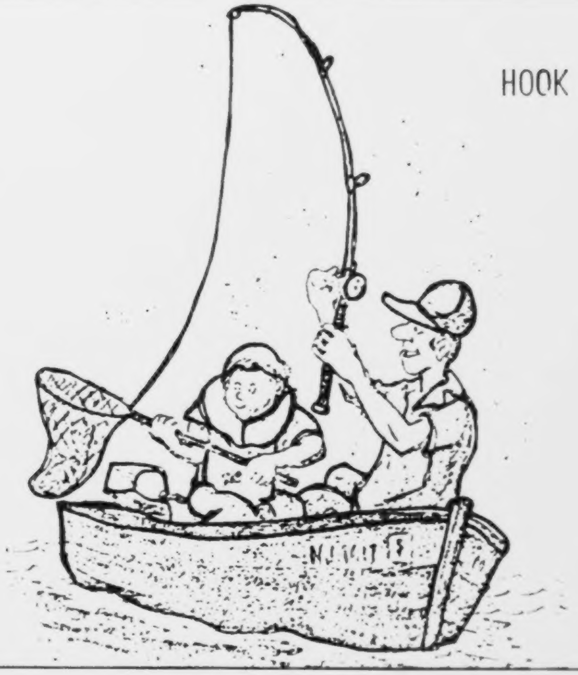


Atlantic Hard Crab Pot

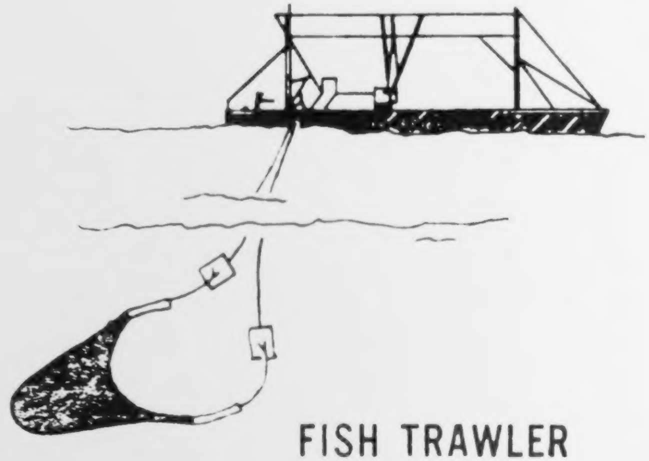


Rake

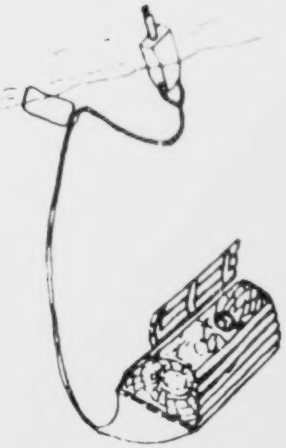
TOOLS OF THE TRADE



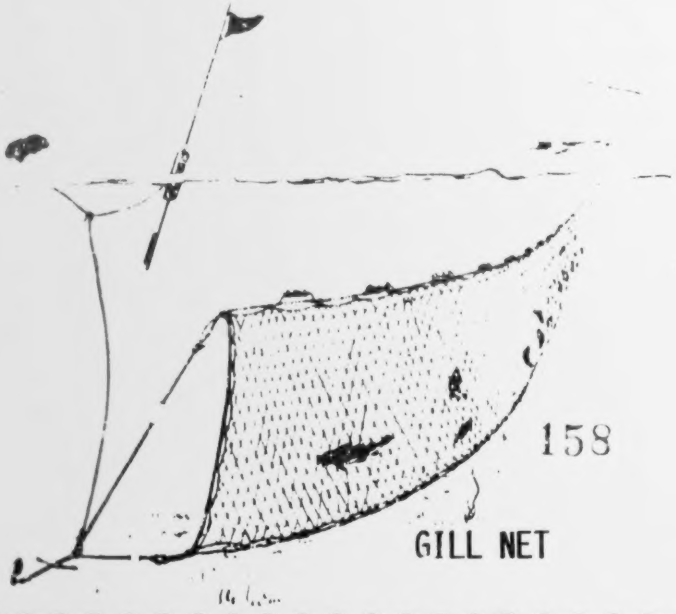
HOOK AND LINE



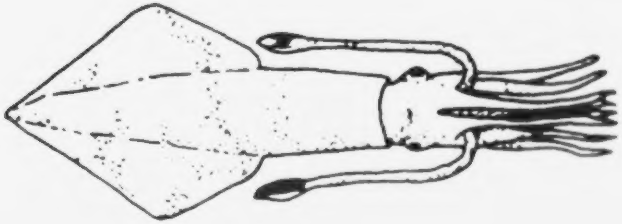
FISH TRAWLER



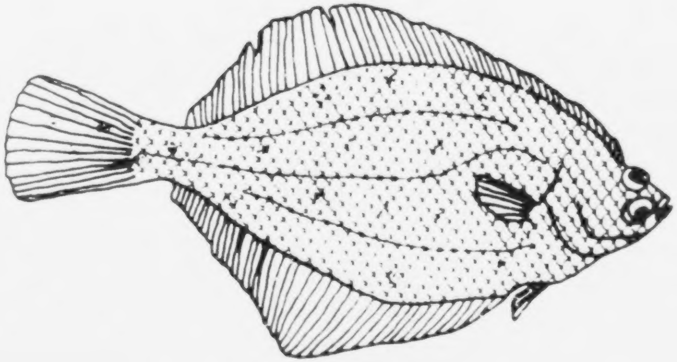
Atlantic Lobster
Pot



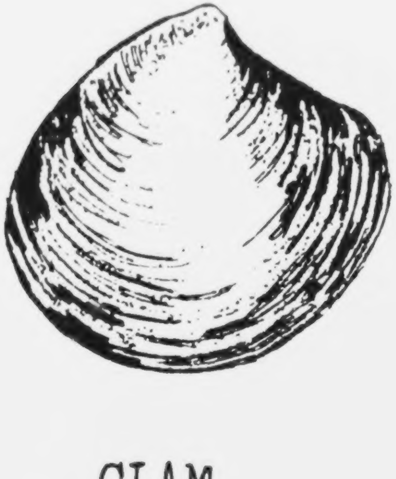
GILL NET



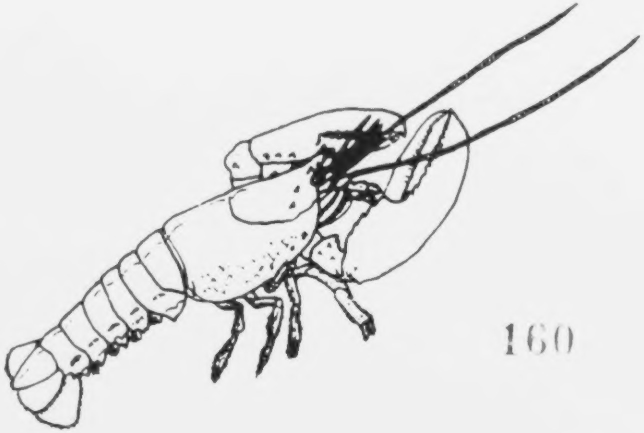
SQUID



FLOUNDER

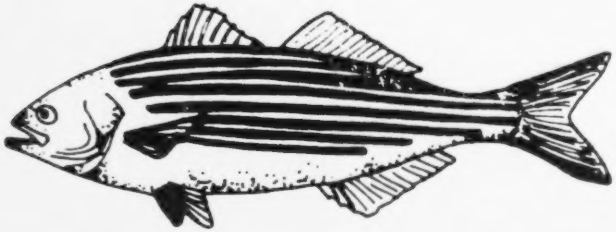


CLAM

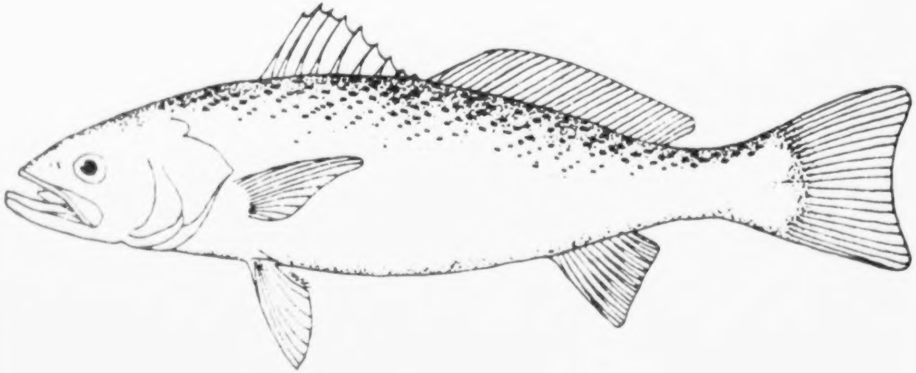


LOBSTER

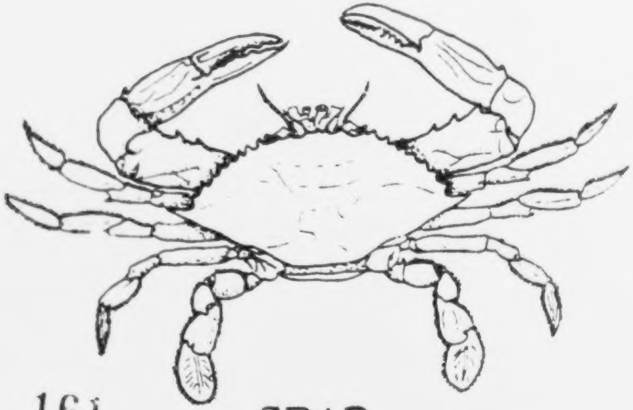
TOOLS OF THE TRADE



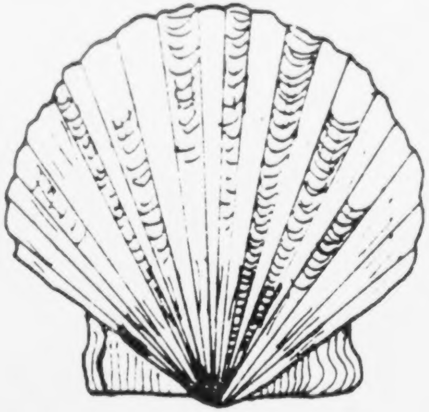
STRIPED BASS



WEAKFISH



161 CRAB



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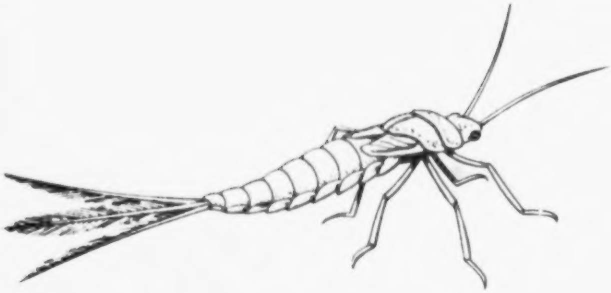
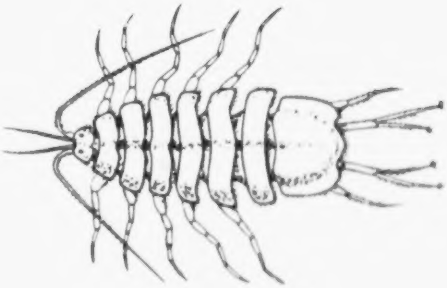
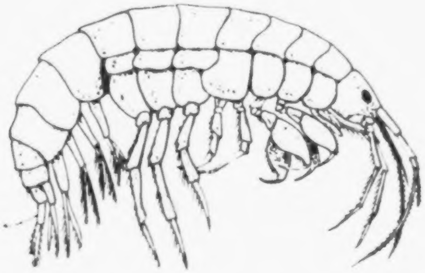
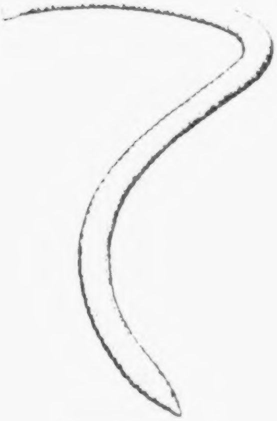
SCALLOP

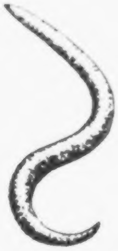
INDICATOR SPECIES

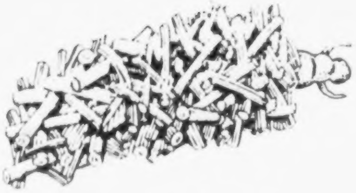

Mayfly larvae

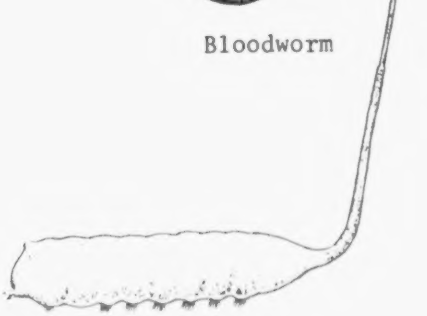

Water Louse


Freshwater shrimp


Sludge worm


Bloodworm


Caddis fly larvae


Rat-tailed maggot

Classification of the degree of pollution using indicator species

Indicator species	*Extent of pollution*
Trout, mayfly nymphs	no pollutants
Freshwater shrimp (Gamarus species)	slightly polluted
Caddis fly larvae	
Bloodworm (chironomid), water louse	heavily polluted
Sludge worm, rat-tailed maggot	very heavily polluted

Vessel ____________________

VESSEL INSPECTION REPORT

1. VESSEL IN GENERAL	GOOD	FAIR	POOR
a. Hull			
b. Docks			
c. Bulwarks			
d. Ladders and stairways			
e. Handrails			
f. Watertight doors			
g. Vents, plugs, covers			
h. Storage of flammables			
i. Other			

2. ENGINE ROOM	GOOD	FAIR	POOR
a. Guards (pulleys, v-belt, etc.)			
b. Relief valves (tanks, hot water heater, etc.)			
c. Deck plates			
d. Insulation			
e. Bilges			
f. Leaks (fuel, oil, etc.)			
g. Other			

3. ELECTRICAL LIGHTING	GOOD	FAIR	POOR
a. Lighting			
b. Protective globes cages			
c. Small appliances tools			
d. Emergency lighting			
e. Searchlight(s)			
f. Running lights			
g. Position lights			
h. Navigation equipment			
i. Other			

4. LIVING QUARTERS	GOOD	FAIR	POOR
a. Galley in general			
b. Stove			
c. Refrigerator			
d. Freezer			
e. Sleeping quarters			
f. Heads			
g. Other			

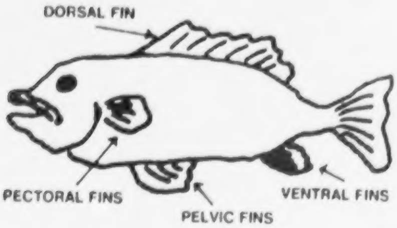
5. SAFETY EQUIPMENT AND ALARMS	GOOD	FAIR	POOR
a. Life preservers How many? ___			
b. Work vests How many? ___			
c. Life rings			
d. Life raft or float			
e. Life ring lights			
f. Fire extinguishers How many? ___			
g. Fire hose			
h. Fog bell			
i. Whistle			
j. Flares			
k. Radios			
l. First-aid kit			
m. Bilge pump			
n. Other			

REMARKS/SUGGESTIONS: (Explain any item marked FAIR or POOR.)

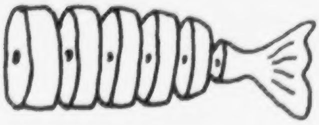
Captain's Signature ____________________

Date ____________________

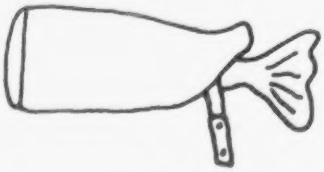
CLEANING YOUR CATCH


DORSAL FIN
PECTORAL FINS
PELVIC FINS
VENTRAL FINS

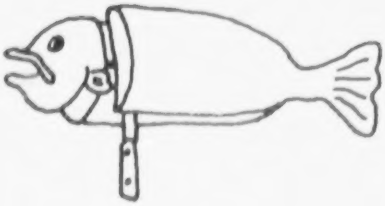
Cutting Steaks



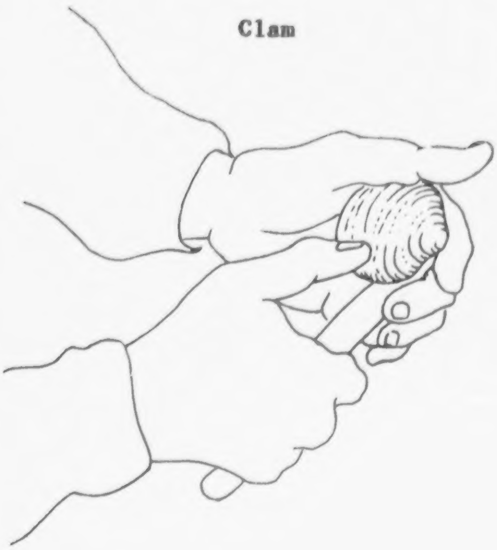
Skinning



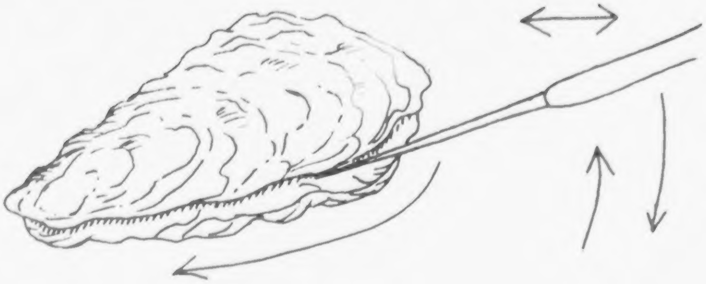
Filleting



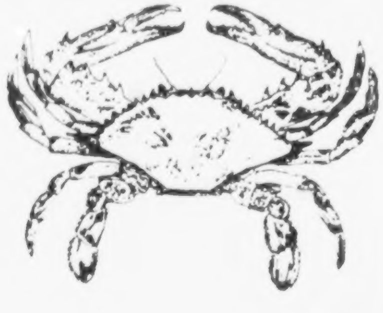
Clam



Oyster



Crab



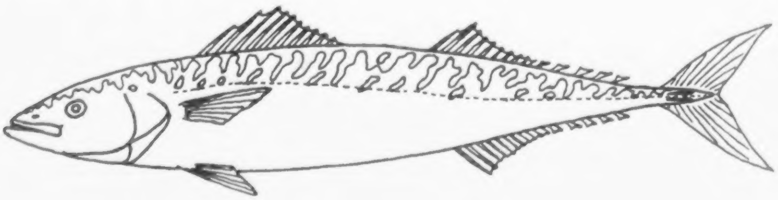
QUICK AND EASY FRIED FISH

1/2 pound pan-dressed fish OR
Salt, for sprinkling
1/3 pound fish fillets, per person
1 to 2 cups dry pancake mix
Lemon and pepper seasoning, for sprinkling
Fat or oil, for frying

Wash and dry fish. Dip fish into clean, cool water, sprinkle lightly with salt and lemon and pepper seasoning; then coat lightly with pancake mix.

Fry in deep fat at 350°F. for 4 to 5 minutes, or fry in 1 1/2 inches hot fat in fry pan, 4 to 5 minutes on each side. (Fish is done when browned on both sides and flakes easily when tested with a fork. Be careful not to overcook.)

Remove fish from pan and drain on paper towel. Serve with cocktail or tartar sauce.
Note: If desired, fish may be pan-fried over medium to low heat, in just enough fat or oil to keep from sticking, until done as described above.



HEARTY FISH CHOWDER

one, 1 1/2 inch cube salt pork, diced
2 cups cooked diced potatoes (about 3 medium potatoes)
1 cup chopped onion (2-3 medium)
1 1/2 pounds skinless fish fillets, cut into pieces
1 quart milk
Salt and pepper, to taste
Water, to cover

In 4-quart pan, cook salt pork slowly until lightly browned. Add onions and cook until tender but not browned. Add fish; add water to almost cover fish. Cover and simmer slowly until fish flakes easily when tested with a fork, 10 to 15 minutes. Add potatoes; slowly stir in milk, over very low heat. Add salt and pepper. Make sure that mixture does not come to the boiling point as the milk will curdle and ruin the appearance of the chowder.

Chowder improves upon standing as flavors get a chance to blend, so this is a good "prepare ahead" dish. Let mixture come to room temperature and then refrigerate until ready to use. Reheat over very low heat, stirring often, until chowder is hot, but not to the boiling point. Put a small piece of margarine or butter over each portion and serve with crackers.

Makes about 10 cups chowder (ample for 6 servings as a main course).

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NEW ENGLAND CLAM CHOWDER

3 quarts shucked clams
1/4 pound diced salt pork or bacon
2 cups chopped onion
2 cups chopped celery
2 quarts diced potatoes
2 bay leaves
1 1/2 tablespoons salt
1/2 teaspoon pepper
2 1/2 quarts hot milk
1/4 cup margarine or butter

Drain clams and save liquid. Remove any shell particles and chop clams. Fry salt pork or bacon until crisp. Add onion and celery and cook until tender. Add potatoes, bay leaves, salt, and pepper. Cover and bring to the boiling point; simmer about 20 minutes or until potatoes are tender. Add chopped clams and liquid and cook an additional 5 to 10 minutes or until clams are done. Add milk and margarine; heat until hot enough to serve. Remove bay leaves. Serve using a 1-cup ladle. Garnish with chopped parsley. Serves 25.

MANHATTAN CLAM CHOWDER

3 quarts shucked clams
1/4 pound diced salt pork or bacon
2 cups chopped onion
2 quarts diced potatoes
2 cans (1 pound, 12 ounces each) tomatoes*
1 quart hot water
1 tablespoon salt
1/2 teaspoon pepper
1/4 cup margarine or butter
1/4 cup chopped parsley

Drain clams and save liquid. Remove any shell particles and chop clams. Fry salt pork or bacon until crisp in large heavy pot or saucepan. Add onion and celery and cook until tender. Add potatoes, tomatoes or tomato juice, and water. Cover and bring to the boiling point; simmer about 20 minutes or until potatoes are tender. Add chopped clams and liquid, salt and pepper, and cook an additional 5 to 10 minutes or until clams are done. Add margarine; heat. Serve using a 1-cup ladle. Garnish with chopped parsley. Serves 25.
*Note: 2 quarts tomato juice may be substituted in place of the tomatoes.

CHESAPEAKE BAY CLAMBAKE

6 dozen soft-shell clams
12 small onions
6 medium baking potatoes
6 ears of corn in the husks
12 live, hard-shell blue crabs
Lemon wedges
Melted margarine or butter

Wash clam shells thoroughly. Peel onions and wash potatoes. Parboil onions and potatoes for 15 minutes; drain. Remove corn silk from corn and replace husks. Cut 12 pieces of cheesecloth and 12 pieces of heavy-duty aluminum foil, 18 x 36 inches each. Place 2 pieces of cheesecloth on top of 2 pieces of foil. Place 2 onions, a potato, ear of corn, 1 dozen clams, and 2 crabs on cheesecloth. Tie opposite corners of the cheesecloth together. Pour 1 cup of water over the package. Bring foil up over the food and close all edges with tight double folds. Make 6 packages. Place packages on a grill about 4 inches from hot coals. Cover with hood or aluminum foil. Cook for 45 to 60 minutes or until onions and potatoes are cooked. Serve with lemon wedges and butter. Serves 6.

*****

A CLAMBAKE

You will need:

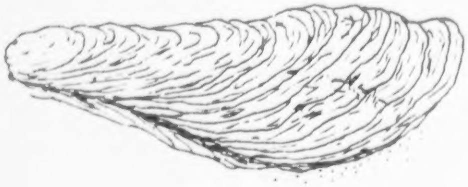
A washtub, clam boiler, or large enamel pot with cover
Lots of seaweed
1 quart of fresh water
8 baking potatoes, scrubbed and wrapped in foil
4 chickens cut up, each portion wrapped in cheesecloth
8 one-pound lobsters
8 ears of corn, husked and wrapped in foil
Plenty of steamer clams
Melted butter
Salt and pepper

You can have your clambake on the beach over a charcoal grill; or, if you prefer, you can cook it at home on the stove. The quantities given are for eight people, but the amounts can be increased or decreased. The only limit is the size of your pot.
First dig the clams, scrub them well with a brush, and let them soak in a bowl or pail of fresh water for at least an hour. Rinse the seaweed several times; then soak it for about forty-five minutes in fresh water to get rid of sand. Prepare the rest of the ingredients.
Now line the bottom of the pot with a four-inch layer of wet seaweed. Add the water and put the pot over high heat. When the water boils, add the potatoes and more seaweed. Cover and cook over lower heat for 15 minutes.
Add chicken pieces and a layer of seaweed. Cover and cook 15 minutes more.
Add the lobsters and more seaweed. Cover and cook 8 minutes .
Add the foil-wrapped corn, cover, and cook 10 minutes.
Add the clams. Cover and steam until the clams open - from 5 to 10 minutes.
The total cooking time is about one hour. Now take out just enough food for the first round, keeping the rest hot in the pot. Use clam shells for your melted butter and dunk everything in it.

OYSTERS CASINO

3 slices bacon, chopped
1 small onion, chopped
1 small stalk celery, chopped
1 teaspoon lemon juice
1 teaspoon salt
1/8 teaspoon pepper
6 drops Worcestershire sauce
4 drops hot sauce
1/4 teaspoon seafood seasoning
1 pint shucked standard oysters, drained.

Fry bacon until partially cooked. Add onion and celery and cook until tender. Add lemon juice and seasonings.
Arrange oysters in single layer in foil-lined shallow baking pan. Spread bacon mixture over oysters. Bake at 400°F. until edges of oysters begin to curl, about 1 minutes.
Makes about 3 dozen appetizers or serve on toast, with liquid, as an entree (Makes 4 servings)



OYSTER KABOBS

1 dozen oysters, drained
3 strips bacon
1 dozen fresh mushroom caps
1/4 pound butter, melted
1 large green pepper

Cut bacon and pepper into bite-sized squares. Skewer oyster, bacon, mushroom cap, and green pepper on toothpicks. Place in a shallow baking dish with melted butter. Bake at 450°F for 15 minutes or until bacon browns.

STEAMED BLUE CRABS

1/2 cup seafood seasoning
1/2 cup salt
3 cups white vinegar
3 cups beer (or water)
3 dozen live (and lively)
  Blue Hard Crabs

Mix seasonings, vinegar and beer (or water), well. Put one-half of crabs in very large pot with rack and TIGHT fitting lid.** Pour one-half of seasoning mixture over top. Add rest of crabs and remaining liquid. Steam, covered, until crabs turn bright red in color, about 20 to 30 minutes. Serve hot or cold.
Makes about 9 to 12 servings, depending upon size of crabs.
**If two pots are used, layer crabs and measure seasoning mixture accordingly.
Note: Serve crabs immediately if to be eaten hot. To serve cold, bring to room temperature and refrigerate until ready to use.
Under NO circumstances should live and steamed crabs ever be stored in such a manner that they could come into contact with each other.

STEAMED CLAMS CHESAPEAKE

4 dozen small soft shell clams in
  shell OR
3 dozen cherrystone clams in shell
  Salt and pepper, for sprinkling
  Seafood seasoning, for sprinkling
  (if desired)
1/2 cup water
  Melted margarine or butter

Wash clams thoroughly. Place in pan. Sprinkle lightly with seasonings. Add water, cover tightly, and bring to boiling point. Reduce heat and steam 10 to 15 minutes or until shells open wide. Drain clams, reserving liquid. Strain liquid.
Serve clams hot in shells with separate containers of clam liquid and melted margarine or butter.
Makes 4 servings as an appetizer; 2 servings as a main dish.

CRISFIELD CRAB-BURGERS

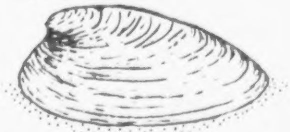
1 pound claw crabmeat
2 tablespoons minced green pepper
3/4 cup finely chopped celery
2 tablespoons minced onion
1 cup mayonnaise
1 cup small cubes mild cheese
  Few drops Worcestershire sauce
  Few drops hot sauce
  Salt, to taste
  Lemon & pepper seasoning-to taste
  8 hamburger buns split in half
  Grated Parmesan cheese; topping

Remove cartilage from crabmeat. Mix crabmeat, green pepper, celery, onion and mayonnaise in a bowl. Add Worcestershire sauce, hot sauce, salt and lemon and pepper seasoning. Put hamburger buns on a cookie sheet and lightly brown in broiler. Remove from heat and spread crabmeat mixture on buns. Sprinkle cheese over top. Broil 4 inches from source of heat, until lightly browned and bubbly. Serve at once. Makes 8 servings.

CLAMS CASINO

12 cherrystone clams in shell
1 to 2 drops Worcestershire sauce
1 to 2 drops hot sauce
3 strips partially cooked bacon,
  cut in 1/4's
  Seasoned breadcrumbs; topping

Open shells, letting clam remain in one half; discard other half. Arrange clams in shallow baking pan. On each clam put Worcestershire sauce, hot sauce, bacon and breadcrumbs.
Broil, 4 inches from source of heat, until edges of clams curl and bacon is done (2 to 3 minutes).
Makes 12 appetizers.



References

Kohn, Bernice; illustrated by Arabelle Wheatley. **The Beachcomber's Book**. Viking Press. New York, 1970.

Ricciuti, Edward R. **Secrets of Shellfishing**. Hancock House Publishers. Killingworth, CT, 1982.

Maryland Seafood Cookbook 1. Gordon P. Hallock, Director of Seafood Marketing Authority, Department of Economic and Community Development. Annapolis, MD.

Dock To Dish, What to Do With a Fish. Eat More Fish, Inc. Wildwood, NJ, 1981.

SHELLS OR FINS

I. Define finfish and shellfish, listing two characteristics of each. Draw an example of each.

II. Circle the species which does not belong in the classification with the others. In the provided space, indicate whether the remaining species are finfish or shellfish.

Shrimp, Crayfish, Trout ____________________

Tuna, Scallop, Sea Bass ____________________

Oyster, Flounder, Lobster ____________________

Sardine, Clam, Crab ____________________

Mackerel, Mussel, Clam ____________________

III. In the space provided, place an F if the species is a finfish, and an S if the species is a shellfish.

____ Salmon

____ Flounder

____ Trout

____ Bay Scallop

____ Sardine

____ Whiting

____ Mussel

____ Blue Crab

____ Tuna

____ Cod

____ Gulf Shrimp

____ Clam

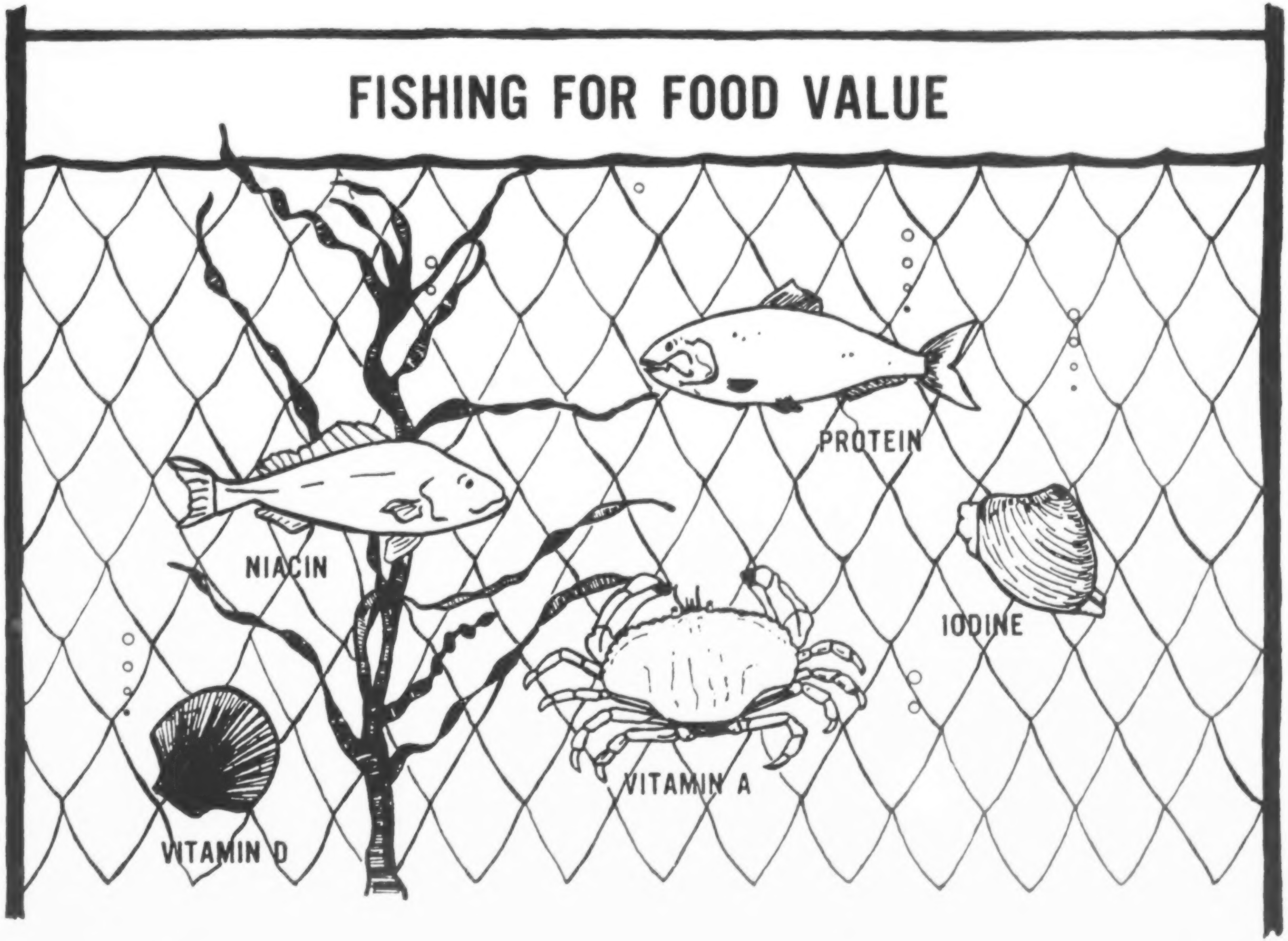
____ Herring

____ Lobster

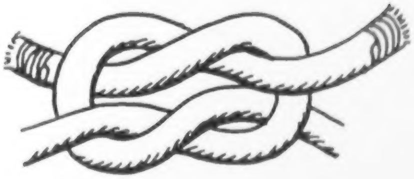
SUPERMARKET SCAVENGER

Locate ten (10) species of seafood which are available in two of the three basic market forms (fresh, frozen, canned). Complete the following chart by placing a check mark (✓) under the headings of the available forms.

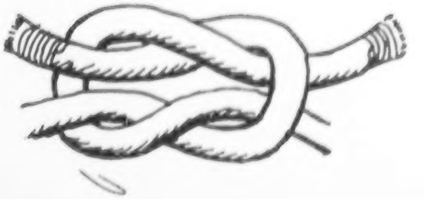
SPECIES	FRESH	FROZEN	CANNED
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			


FISHING FOR FOOD VALUE
PROTEIN
NIACIN
IODINE
VITAMIN A
VITAMIN D

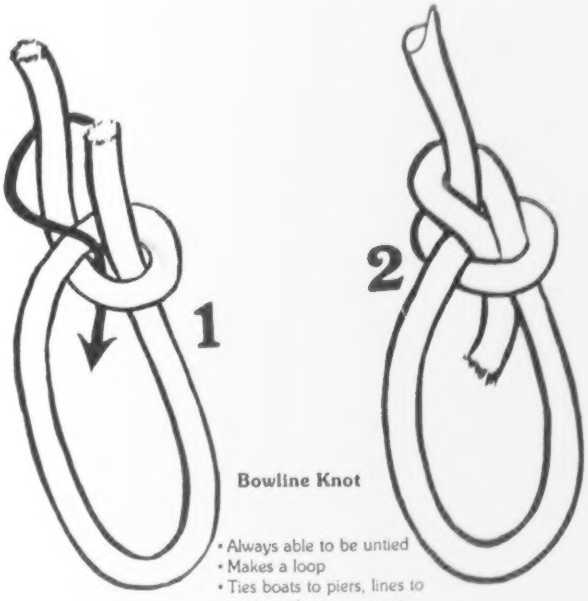
"KNOT TYING"



The **Granny knot,** or lubber's knot, is sometimes tied by mistake instead of a square knot. It is unsafe, however, and should always be avoided.

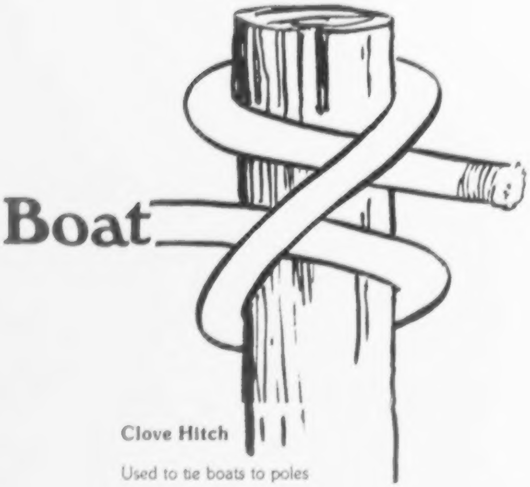


The **square knot,** or reef knot, is used in reefing (temporarily reducing the area of a sail), in tying up bundles of all kinds and for many other purposes. It is insecure if the two cords are of different sizes or materials.



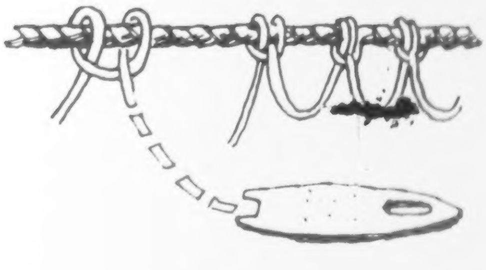
Bowline Knot

- Always able to be untied
- Makes a loop
- Ties boats to piers, lines to anchors, has many uses

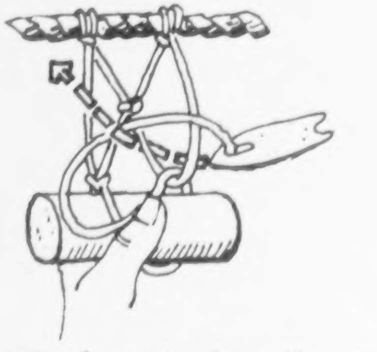


Clove Hitch

Used to tie boats to poles



Clove hitch is used to attach twine to headline



Fisherman's netting knot (the way of tying a sheet bend for netting)

Appendix II

Additional Resources

FIELD TRIP PLANNING GUIDE

A field trip is always an exciting way to expand on learn-by-doing activities. They often serve to broaden the horizons of participants allowing them to see and experience new things.

Along with experiencing new things a field trip enables members to see first hand the principles and processes discussed at meetings and in books.

Planning a field trip begins with the objective or purpose for making the trip. Be clear on your purpose and the goals of the field trip before beginning planning.

A good field trip is well planned in advance. Haphazard planning and vague ideas leave many loop holes for wasted time and missed opportunities.

The distance traveled for a field trip does not determine its success. Many times there are excellent field trip opportunities "right in our own backyard." Be sure to check local resources before assuming that you have to travel to accomplish your goal.

The following suggestions will help you to better insure the success and relevance of the field trip experience.

Before the Trip:

Set your Goals - What do you want to accomplish on this field trip? Why are you taking this trip? What experiences do you want your 4-H members to gain from the trip?

Consider your Local Resources - Field trips always carry with them some aggravating problems. Don't complicate your planning by adding great distance if it isn't necessary.

Always visit a field site prior to taking your club or groups there. This will enable you to realize how best the field site can be adapted to your goals, what you can expect the members to accomplish, and any expenses which might be incurred.

Plan trips to a field site during an appropriate season.

Decide on your form of transportation, call your local bus company to find out costs (if any) of the bus, tolls, etc.

Distribute and collect permission slips from 4-H members. Encourage parents, co-leaders to accompany your club. It helps greatly to have additional adults on the trip.

Prepare a set of 2 attendance lists - one for you, one for another supervising adult that will be accompanying you.

Be sure to know the best route for the bus to take to the field site. Discuss this with the driver prior to leaving. If you are taking cars be sure everyone understands the directions.

Materials generally needed by the 4-H leader:

first-aid kit
whistle
sun glasses
additional materials needed for the activities
plastic garbage bags
clip board, paper, & pencil
reference materials

Discuss with the 4-H members the appropriate conduct for the trip; materials needed (clothing, cameras, jars, notebook, etc.); avoidance of hazards, lunch time, etc.

All participants must wear sneakers or shoes at all times (even in water).

Prepare 4-H members for trip by discussing the problems to be investigated at the field site, and by actively getting them involved in the preparation. For example, the obtaining of simple materials, construction of home made sampling equipment, researching the physical characteristics of the area, its history, names of organisms found at the site, etc.

On the Trip:

Remind 4-H members before departing of the purpose of the trip, the appropriate conduct, and distribute worksheets.

Warn your members of any possible hazards at the site.

Allow 4-H'ers to work at their own speed. Listen, observe, and ask pertinent questions and this will ensure adequate progress.

Institute changes in the assigned procedures as these are deemed necessary.

Suggest, when appropriate, additional projects for investigation.

Leave the area in a better state than you found it, if feasible.

Appoint one student in each group to check on the equipment to assure its safe arrival and return.

REMEMBER: There is a fine line between constructive permissiveness and chaos. Allow members a degree of freedom while pursuing YOUR prescribed course of "discovery learning."

Relax, address problems and changes as they arise but don't let them upset you. Do the best you can - your efforts are appreciated.

After the Trip:

At a club meeting, your members discuss investigations and how they apply to their project work.

Help them coordinate information gained on the trip and relate it to the concepts in the area of study. This will result in an ongoing process which will continue throughout their 4-H project work experience.

Share your experiences and enthusiasm with other groups in 4-H in order to stimulate interest among other 4-H leaders and members.

Many of the experiences gained on a field trip can be used in exhibits or displays. Encourage your members to apply their learning to other areas of 4-H participation. For example, a public presentation: "Our Trip To The Beach."

Reference

Marine And Aquatic Field Trip Guide To New York State. New York Sea Grant Institute, University of New York and National Oceanic and Atmospheric Administration (NOAA), US Department of Commerce.

RECORD KEEPING

Keeping 4-H records encourages members to plan ahead, keep track of what they have done, and evaluate their success. Records are often used to help select members for county, state or national awards. Encourage members to begin keeping a record of their project right from the beginning.

Records may be designed in a variety of ways. One suggestion:

Have each member get a notebook preferably one with note paper as well as pockets for completed worksheets. You may want to spend one meeting making covers for their notebooks to personalize their records. After each meeting members can jot down what they accomplished at the meeting.

Possible format may include:

Date: Topic:

What we did:

What we learned:

New questions:

Other things I would like to do or learn:

This is very basic but will help members in beginning to keep records.

On field trips a different format may be used:

Date Area Name

Describe the Area:

Observations:

Questions to Research:

Illustrations:

A beachcombing worksheet is included in Appendix I for use on beach, bay, lake etc., field trips.

4-H PROJECT PLANNING GUIDELINES

There are many things to learn and do in the 4-H Marine Science project. The objective in this project is to encourage 4-H members to participate in a variety of activities both in their project and in other 4-H events.

Encourage members to design a plan for what they would like to accomplish in their club. Your guidance in planning is essential. Help members to set realistic attainable goals. You will find that these plans are most successful and will meet the needs of your members when everyone is involved in identifying what to do, when to do it, and how.

Project Planning Meeting

A project planning meeting will provide an excellent opportunity for 4-H members:

-to develop life skills of planning, decision making, working together, accepting a group decision and feeling a sense of ownership.
-to plan the year's program to include business meetings, educational experiences, and recreation.

As you plan this meeting you may want to ask your members and their parents to discuss what they would like to do and learn. This will also serve to involve parents in club activities.

Materials Needed:
.pencils, paper, or blackboard
.4-H Marine Science Leaders Guide
.list of county 4-H programs and events with dates

As the project leader you set the stage, providing the opportunity for members (and their parents) to develop skills.

It is not always each to sit back and allow members to work together and come up with ideas. To generate ideas and arrive at group decisions, have each person write down ideas for meetings. Provide members with information on events, activities, etc. available.

You may want to put members into groups of 2 or 3 to work. Allow 5-10 minutes. Have each member or group share their ideas. Record all suggestions without discussion. Members may explain or clarify their ideas.

From all ideas generated have members rate the suggestions in order of their preference. You may want them to choose their 5 favorites and rank them 1-5, 5 being favorite. Have each member give their ranking as each idea is read. Add up the numbers, allow time to discuss the choices as they relate to the club's goals. From the decisions made, make up a list of topics for the year's program.

As the time for events or activities approach, involve members in taking responsibility for parts of each activity. Allow as many members as possible to have a responsibility.

You may want to complete an outline for the year to show all members the plan. Copies can be made for each member.

4-H Club Planning Guide

Club ______________________________

Leaders ______________________________

Meetings _____ (number of time(s) a month)

Month	Day	Business Meetings	Educational Meetings	Recreation
		Topics (include fund raising projects, election of officers, etc.)	Programs (include field trips, films, speakers, as well as project meetings and county programs)	(include picnics, parties, outings, etc.)
O C T				
N O V				
D E C				
J A N				
F E B				

183

Month	Day	Business Meetings	Educational Meetings	Recreation
MARCH				
APRIL				
MAY				
JUNE				
JULY				
AUG				
SEPT				

ADDITIONAL RESOURCES

The following are some additional references which you may find helpful in guiding your members in the 4-H Marine Science project.

ABC'S of the Ocean, by Isaac Asimov; illustrated with photographs and black and white drawings. Walker & Co., 1970, 48 pages.

Asimov chooses two items for each letter to represent this aquatic alphabet. Pronouncing guides are included for words like Ichthyologist (ik-thee-OL-o-jist), and not for words where such a guide would be unnecessary. Accurate, carefully done in a way to invite further investigation, both pictures and script will be of interest to people far advanced from kindergarten age, but even young children will appreciate how Asimov teaches without talking down to his young audience.

Grades K-up

Along the Seashore, by Margaret Waring Buck; illustrated by author. NY: Abingdon Press, 1964, 72 pages.

A marvelous information book describing sea grasses, shell, mollusks fishes, and birds. Illustrated in black and white pen drawings for identification. Index and bibliography.

Grades 1-up

America Sails the Seas, by John O'Hara Cosgrave II. Boston: Houghton Mifflin, 1962, 95 pages.

This is a chronological history of American ships from Indian canoes to Polaris submarines; ships of each period are described in text and detailed diagrams; many pictures are in full color.

Grades 4-8

Animals of the Seas, by Millicent E. Selsam; illustrated by John Hamberger. NY: Four Winds Press, 1975, 40 pages.

This book is what we have come to expect of Selsam books - accurate scientific facts written with style and imagination. This information book gives facts on the food chain as it operates in the sea, and gives descriptive text about several of the animals in which children are most interested. Hamberger's full color illustrations are carefully integrated into the text. Indexed, with average sizes of animals listed.

Grades Preschool-3

Animals That Live in the Sea, by Joan Ann Straker; illustrated with full color photographs. Washington, D.C.: National Geographic Society, 1978, 32 pages.

This pictorial information book contains an array of unusual fishes in close-up photography and brief text.

Grades K-6

Arms of the Sea, Our Vital Estuaries, by Elizabeth Shepherd; illustrated with photographs. NY: Lothrop, Lee & Shepard, 1973, 160 pages.

An information book that describes the estuaries, the fish, birds, and other animals that depend on them for life; index and bibliography.

Grades 4-up

Atlas of the Oceans, The Rand McNally. NY: Rand McNally, 1977, 208 pages.

This comprehensive atlas is intended for adults, but its wealth of

pictures, charts and maps as well as its clear writing style make it useful for any group of older children. Full color photographs include detailed pictures of marine life; the book explores the resources available in the oceans and includes a glossary and index.
Grades 7-up

Beach Bird, by Carol and Donald Carrick. NY: Dial Press, 1972.
Beautiful book about a sea gull with a map of the place where it lives. It includes closeups of plants growing in the sand and vast distances of the sea where "row after row of waves raced one another to shore." There is much sea lore here with good descriptions of the food chain; for example, what the periwinkles eat, and what - in turn - is waiting to eat them.
Grades K-4

The Beachcomber's Book, by Bernice Kohn; illustrated by Arabelle Wheatley. NY: Viking, 1970 (Puffin paper 1976), 96 pages.
This well written book tells how to look for things on the beach; it identifies many of them, and it suggests (with ample illustration) what can be done with the finds, from sand painting to shell sculpture to sea glass mobiles. It includes sketches and listings of common shells and seaweeds, and it has a bibliography and index. Note: Indiscriminate collecting is currently looked upon with disfavor for ecological reasons.
Grade Preschool-6

Behind the Scenes at the Aquarium, by David Paige; illustrated by Roger Ruhlin, and with photographs. Chicago: Albert Whitman, 1979, 48 pages.

The intricacies of managing the John G. Shedd Aquarium in Chicago is the subject of this book. It discusses how specimens are gathered and maintained. It also suggests, by describing the many jobs to be done, several career opportunities. Index and glossary.
Grades 4-8

The Book of Fantastic Boats, by Christine Bernard; illustrated by Roy Coombs. Racine Wisc: Western Publishing Company, 1974 (Golden Press), n. page.
This is a picture book of some of the strange craft people have devised to carry them across the waters. It is not in chronological nor, seemingly, any other kind of order, and it gives only brief descriptions of each of the ships pictured. Because of the strange viewpoints presented - some are viewed from above, some below, others in different ways - it seems confusing. Glossary of unfamiliar terms.
Grades 4-6

The Challenge of the Sea, by Arthur Clarke; illustrated by Alex Schumburg. NY: Holt, Rinehart & Winston, 1960, 168 pages.
This considers the importance of the underwater world as a frontier to be explored. Indexed.
Grades 4-8

Clams Can't Sing, by James Stevenson; illustrated by the author. NY: William Morrow, 1980, 32 pages.
This is a book about the sounds of the beach. Beatrice and Benny thought that clams didn't make any noise or do anything; this corrects some of their misconceptions.
Grades 1-3

Come with Me to the Edge of the Sea, by William M. Stephens; photographs by the author. NY: Julian Messner, 1972, 80 pages.

A beautiful book about the seashore, tidal pools, and the creatures that inhabit these places, it includes hints on collecting mollusks, but also contains the admonition about indiscriminate collecting which destroys the lives of those creatures still living in shells. Photographs are carefully labeled and integrated into the text.

Grades 3-up

Commercial Fishing, by Herbert S. Zim and Lucretia Krantz; illustrated by Lee J. Ames. NY: William Morrow, 1973, 64 pages.

This is an information book about the lives of professional fishermen, the ways fish are located and caught, and the varied harvest of the sea.

Grades 4-6

Crabs, by Herbert S. Zim and Lucretia Krantz; illustrated by Rene Martin. NY: William Morrow, 1974, 64 pages.

This discusses how crabs live, what they feed on, how they use their senses, and the many different kinds of crabs there are.

Grades 4-6

The Craft of Sail, by Jan Adkins; illustrated by author. NY: Walker & Company, 1973, 64 pages.

Adkins writes, illustrates, and designs his books; this means that he counts words, even letters, to make certain each page is aesthetically pleasing. The result is a rich experience for the reader-viewer. **The Craft of Sail** is a carefully detailed study of sailing vessels; it includes charts that show various kinds of sails, knots, chart symbols, as well as engineering principles written and illustrated so even the youngest reader can understand. Index.

Grades 3-up

Diving for Science, by Lynn Poole; illustrated by Jeanne Bendick. NY: McGraw-Hill, 1955, 160 pages.

Beginning with scuba and snorkel, this is an information book about divers and the discoveries they make underwater. Pronouncing guides throughout, as well as clear writing make this a good resource book. Indexed.

Grades 4-6

Easy Experiments with Water Pollution, by Harry Sootin; illustrated by Lucy Bitzer. NY: Four Winds Press, 1974, 112 pages.

This information book gives background information on water pollution and shows how to conduct experiments. Illustrations include drawings and diagrams.

Grades 3-7

A Fish Hatches, by Joanna Cole; photographs by Jerome Wexler. NY: William Morrow, 1978, 39 pages.

This is a science book about how a trout embryo develops from egg to full-sized fish. Told in straightforward text with carefully executed photography, this is a fine blend of text and pictures to give children an information book that is first-rate.

Grades K-4

The Fishes, by F.D. Onmanney. NY: Time Life Books, 1967, 128 pages.

This "Young Readers Edition" is a marvelous, descriptive text with pictures of fish, their life habits and how food is harvested from the oceans. Illustrated with full color photographs, maps and drawings. Index.

Grades 3-8

Fishes, by Herbert S. Zim and Hurst H. Shoemaker; illustrated by James Gordon Irving. NY: Golden Press, 1955, 160 pages.

This is a guide to the more common of the world's fishes, both saltwater and fresh with full color illustrations and classifications listed for easy identification. Bibliography and index.

Grades 4-up

From Shore to Ocean Floor: How Life Survives in the Sea, by Seymour Simon; illustrated by Haris Petie. NY: Franklin Watts, 1973, 88 pages.

This information book discusses the characteristics that determine the survival of plants and animals in the sea, and it includes the dangers involved when an oil spill occurs. Includes list of books and articles for further reading. Indexed.

Grades 4-6

A Great Aquarium Book, by Jane Sarnoff and Reynold Ruffins. NY: Scribner's, 1977, 48 pages.

This is a beginning book for people who want to care for fish in an aquarium. It is filled with riddles, fun facts, and solid facts for young readers who know nothing about fish or fish tanks.

Grades 3-8

Jobs in Marine Science, by Frank Ross, Jr.; illustrated with photographs. NY: Lothrop, Lee & Shepard, 1974, 96 pages.

An information book discussing the careers open in marine science, and the preparatory summer training one might do. Index.

Grades 7-up

The Life of Fishes, by Dr. Maurice Burton. NY: Golden Press, 1974, 62 pages.

This text discusses fishes from the earliest known to people and illustrates them with full color drawings. It includes interesting descriptions of how a paleontologist works, the results of pollution, and how to set up and maintain an aquarium.

Grades 3-up

Marshes and Marsh life, by Arnold Dobrin; illustrated by author. NY: Coward-McCann, 1969, 48 pages.

A sensitive, knowledgeable look at a salt marsh, a place flooded with sea waters at high tide. The abundant life forms, and how the ecology works are clearly and interestingly described.

Grades K-6

Oysters, by Fred N. Grayson; illustrated with photographs and drawings in black and white. NY: Julian Messner, 1976, 64 pages.

This information book discusses oysters as they are found throughout the world, oyster farming, pearl harvesting, and it includes instructions for raising oysters in a controlled environment. Glossary and index.

Grades 4-8

The Pond, by Carol and Donald Carrick; illustrated by Donald Carrick. NY: Macmillan, 1970, n. page.

Poetically written and beautifully illustrated, this describes in very few words some of the animal life supported by a pond.

Grades Preschool-3

The Pond, by John G. Samson; illustrated by Victoria Blanchard. NY: Alfred Knopf, 1979, 134 pages.

The marine theme is central only in that it is a pond that is the basis for the existence of the creatures which live in its vicinity; this pond sustains a remarkable amount of animal and plant life. That is, without the pond the creatures - aquatic and otherwise - would not be in this area for the pond provides the very water needed for their survival (and that makes it in the grandest sense, a marine book). Samson has written about a year in the life of the pond, beginning in winter with the stirrings of life, ending with fall as hibernation and migration occur. Blanchard's pen and ink illustrations in the generous borders of this book are a delicate and charming enhancement of the text. Indexed, with a brief bibliography. A superb book.

Grades 4-up

Pond Life, by George K. Reid; illustrated by Sally D. Kaicher and Tom Dolan. NY: Golden Press, 1967, 160 pages.

This guide to plants and animals of North American ponds and lakes is illustrated in full color and intended to be used as an identifying tool on field trips. Definitions are clear and exact with illustrations, and an overview of ponds and lakes is included. Indexed with brief bibliography.

Grades 4-up

Pond and Marsh Plants, by Olive L. Earle; illustrated by the author. NY: William Morrow, 1972, 64 pages.

An information book about water-loving plants, wild and cultivated. Index.

Grades 4-6

Questions and Answers About Seashore Life, by Ilka K. List; illustrated by Arabelle Wheatley; woodcuts by the author. NY: Four Winds Press, 1970, 123 pages.

This is an information book about animals and plants that live in the oceans. Meant to be appreciated by readers ages eight and up, it contains well-written information to appeal to any age and is accompanied by clear illustrations in brown and white that are artistic and scientific.

Grades 3-up

The Sea Around Us, by Rachel Carson. NY: Oxford University Press, 1951, 230 pages.

This information book about the oceans is clearly written for the junior high and older people who want a comprehensive look at the sea. Bibliography and index.

Grades 7-Adult

The Sea Book, by Doug Morse; illustrated by Joel Snyder. Newburyport, MA: Storyfold, Inc. 1974, n. pages.

This concept in books is really a combination of mural and foldout story,

with pictures in full color on one side of the page sheets with text; the other side of the page sheets contains black and white illustrations, facts, and suggestions for marine activities.
Grades K-up

Sea Star, by Robert M. McClung; illustrated by the author. NY: William Morrow, 1975, 48 pages.
An information book about the life cycle of the starfish.
Grades 1-3

Sea Treasure: A Guide to Shell Collecting, by Kathleen Yerger Johnstone; illustrated by Rudolf Freund and Rene Martin. Boston: Houghton Mifflin Company, 1957, 242 pages.
This book should have appeal for amateur and serious shell collectors; it includes the history of shells, how they have been treasured through the ages, and about the animals which live inside them and build up their armor to protect themselves from other creatures of the sea. Most of the drawings are black and white sketches, but there are a few pages of full color, detailed drawings of shells. Indexed, with bibliography. A good addition to a marine library.
Grades 5-up

Seahorse, by Robert A. Morris; illustrated by Arnold Lobel. NY: Harper & Row, 1972, 60 pages.
This is one of the Harper "I can read" series; the author has a Master's degree in marine biology and is former curator at Marineland of Florida. The text is simple so beginning readers can master it, but the information is accurate and ample. Arnold Lobel's careful, border-contained illustrations add to the understanding of the text. Note: A pronouncing vocabulary list would be helpful for the few difficult words like sargassum.
Grades K-3

Seashells of North America, by R. Tucker Abbott; illustrated by George F. Sandstrom. NY: Golden Press, 1968, 280 pages.
This guide describes and illustrates how shells are formed, how they grow, and where different kinds may be found. Illustrated in full color, an excellent tool for field trip identification. Bibliography and index.
Grades 4-Adult

Seashore, by David Lambert; illustrated with drawings and photographs. Franklin Watts, 1977, 44 pages.
Different habitats of plants and animals are described and pictured; thoroughly scientific yet readable, this is packed with information and describes different kinds of shores and their ecology.
Grades 4-10

Seashores, by Herbert S. Zim and Lester Ingle; illustrated by Dorothea and Sy Barlowe, NY: Golden Press, 1955, 160 pages.
A Golden Guide describing different kinds of shores and the animal and plant life found there. Classification charts are included for aids in identification, and full color illustrations are clear and precise. List of scientific names, index, and brief bibliography.
Grades 4-Adult

The Sunlit Sea, by Augusta Goldin; illustrated by Paul Galdone. NY: Thos. Crowell, 1972, 34 pages.

An information book about the life that abounds in lighted waters, and it includes information about the food chain. A pronouncing guide would have made a nice inclusion; young readers may have trouble with protozoa and copepods.

Grades K-4

Water Plants, by Dorothy Childs Hogner; illustrated with photographs and drawings in black and white. NY: Holiday House, 1977, 96 pages.

Information book discussing several kinds of water plants and their habitat with suggestions for raising water plants at home or school. Also includes suggestions for experimentation with such plants. Glossary, list of books for further reading, and index.

Grades 4-up

Waves, by Herbert S. Zim; illustrated by Rene Martin. NY: William Morrow, 1967, 64 pages.

An information book about ocean waves, especially tidal waves. Index.

Grades 4-6

Waves, Tides, and Currents, by Elizabeth Clemons; illustrated with maps, diagrams and photographs. NY: Alfred A. Knopf, 1967, 112 pages.

This information book is divided into chapters which explain what a tide is. It describes accurately the difference between an ebb tide and flood tides; discusses what causes the tides, and tells of the effect of currents in the oceans. Readable, concise, informative. Glossary, bibliography, and index.

Grades 4-up

Wonders of Jellyfish, by Morris K. Jacobson and David R. Franz; illustrated with line drawings and photographs. NY: Dodd, Mead & Company, 1978, 80 pages.

This science book has clear, detailed illustrations showing the life cycle of jellyfish, cross-section of medusa and polyp forms, and other classification information. It is further enriched with clear black and white photographs of several kinds of jellyfish. Includes a glossary of terms, a bibliography and an index. A good guide for children who want to study this life intensely. This is one of several of Dodd, Mead's "Wonder of...." series which includes starfish, sea gulls, and sponges.

Grades 4-up

Wonders of Sea Gulls, by Elizabeth Anne Schreiber and Ralph Schreiber; illustrated with black and white photographs. NY: Dodd, Mead, 1975, 80 pages.

This book discusses habitat, feeding habits, nest building, and interrelationships between gulls and people. A description of different kinds of gulls is included as in an index.

Grades 6-up

World Beneath the Waves, by Walter Buehr; illustrated by the author. NY: W.W. Norton, 1964, 112 pages.

This is an information book about oceanography and underwater exploring. Indexed.

Grades 3-6

The World of an Estuary, by Heather Angel; illustrated with photographs and line drawings. Salem, NH: Faber and Faber, 1974, 128 pages.

This information book describes what an estuary is; it discusses the plant and animals which live there and how they interact with each other.

Grades 5-up.

The World of a Stream, by Heather Angel; illustrated with photographs and line drawings. Salem, NH: Faber and Faber, 1976, 128 pages.

An information book about the plants and animals which live in streams.

Grades 5-up

Other Materials

Marine Organism Card Game, Sea Grant College Program, Texas A&M University, College Station, TX 77843.

A set of 48 marine organism cards is instructional as well as entertaining. The set can be used for two games, "Who's for Dinner" and "Who Eats Whom." Printed on heavy card stock, comes complete with a separate instruction sheet. It is an entertaining way to learn how the food chain operates and are suitable for ages 10 and up.

Cost .50/set

"Sea Chanties" and **"The Noisy Sea"**- Cassette Tape, Sea Grant College Program, Texas A&M University, College Station, TX 77843.

One cassette tape with representative sea chanties on one side and recordings of sea animals such as snapping shrimp, dolphins and various fish on the other.

Cost $2.00

Activity and game books available from grocery, discount and variety stores.

These generally can be found wherever coloring books are sold and are useful in making the fun folders described. Grosset and Dunlap and Whitman Publishing are two publishers of this type of material.

Marine Animal Charts, Superientendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Full-color charts, each 30 X 48 inches. Order as follows:

Marine Fishes of the North Pacific,
003-020-00051-7, $2.30

Marine Fishes of the Gulf and South Atlantic,
003-020-00065-7, $2.30

Mollusks and Crustaceans of the Coastal U.S.,
003-020-00087-8, $3.20

Marine Mammals of the Western Hemisphere,
003-020-00106-8, $3.00

Cold Water Survival Poster, Hunter Safety News, P.O. Box C-19000, Seattle, WA 98109.

This poster gives techniques for staying afloat when in water unexpectedly. It destroys some old myths about flotation and gives advice on retaining body heat.

Cost:$1.00

Brochures, Printed Materials

Boating Safety Information:

Call Toll Free: 1-800-325-7376, (Missouri Residents call) 1-800-392-7780

Caribbean Tourism Association, 20 E. 46th Street, New York, NY 10017.
Brochure: **"The Caribbean: A World of Its Own"**, which includes a map and colored photographs

Cruise Lines International Association, 17 Battery Place, New York NY 10004.
Map: Routes of trans-Atlantic passenger ships
Brochure: **"Passenger Ships on the Atlantic Ocean"**
Pamphlet: **"Teaching Suggestions for Presenting a Unit on Steamship Travel"**

East Carolina University, Marine Advisory Service, P.O. Box 699, Manteo, NC 27954.
Brochure: No. POSGAP9, January 1976, on net mending and patching, written by P.D. Lorimer, fully illustrated to show netmaking skills and tools used.

Florida Department of Natural Resources, Larson Building, Tallahassee, FL 32304.
Brochure: **"The Story of Sea Turtles"**

Insurance Company of North America, 1600 Arch Street, Philadelphia, PA 19101.
Bulletin: No. HH-3776 **"International Flag Alphabet Charts"**, includes symbols used in alphabet, meanings for individual flags, storm warning flags and other navigation aids and symbols.

Marine Advisory Service, University of Delaware, Newark, DE 19711.
Book: **"Seascapes: Glimpses of Our Water World"**, a 40 page book written by Jan Hardin containing newspaper reprints of articles on ocean life, including jellyfish, diving mammals, gulls and beach erosion.

National Geographic Society, P.O. Box 2330, Washington, D.C. 20013.
Catalogue: Educational aids catalogue listing films, filmstrips and educational kits available through the Society.

National Oceanic and Atmospheric Administration, U.S. Department of Commerce, Rockville, MD 20852.
Maps: Hurricane tracking charts, available in quantities.

National Wildlife Federation, 1412 16th Street, N.W. Washington, D.C. 20036.
Pamphlet: **"Wildlife of Lakes, Streams and Marshes"**
Catalogue: Publications on conservation education

Sea Grant College Program, University of Hawaii, 2540 Maile Way, Spalding Hall 252B, Honolulu, Hawaii 96822.
Workbook: **"Makahiki kai"**, a 31 page brochure with student exercises such as word searches, how to make an algae press and fish printing. No. UNIHI-SEAGRANT-MR-77-01.

Sea Grant College Program, Marine Information Service, Texas A&M University, College Station, TX 77843.
Bibliography: **"Sea Sources"**, a bibliography of literature and information books written for elementary ages, includes a section of free materials as well as a listing of periodicals for teachers of marine education. No. TAMU-SG-79-402.

Brochure: **"Hurricanes on the Texas Coast"**, describes Texas' most notable hurricanes for a 15 year period. Probability of hurricane occurrence, guidelines for individual responsibilities and checklists for action before/during/after a hurricane are included. No. TAMU-SG-75-504.

Brochure: **Trying to "Marinate Your Curriculum?"** includes an order form for all marine education materials currently available. No. TAMU-SG-79-406.

Magazine: **"The University & The Sea"**, published six times a year with articles on various Texas A&M University Sea Grant projects.

Texas Parks and Wildlife, 4200 Smith School Road, Austin, TX 78744.

Instruction: **"How to Water Ski"**

Pamphlets: **"How to Tie Nautical Knots"**
"Canoeing Basics"
"Bird Nests"
"Drownproofing"
"Hypothermia and Cold Water Survival"
"PFD Types"

Pictures: **Wildlife**, 8 x 10, in color, with good descriptions
(Price list of selected bulletins)

U.S. Army Corps of Engineers, P.O. Box 80, Vicksbury, MS 39180.

Booklet: **"Mississippi River Navigation"**, illustrated.

U.S. Department of the Interior, Geological Survey, 1100 Commerce Street, Room 1-C, Dallas, TX 75242.

Pamphlets: **"Marine Geology: Research Beneath the Sea"**
"Our Changing Continent"

U.S. Environmental Protection Agency, Youth, A 107, Washington, D.C. 20460.

Pamphlets: **"Our Endangered World"**
"ABC's of Human Ecology"
"Needed: Clean Water"
"Fun with the Environment"

SUPPLIES

Paper

Newsprint: Newspaper offices often will donate the roll ends of newsprint.

Cut paper: Print shops generally have scrap boxes which yield papers in many colors, usually in small pieces.

Heavy paper: Business form companies often give away roll ends of heavy paper, such as tagboard or backing material.

Transparency film: Used x-ray film generally is discarded by a hospital's radiology department and most hospitals will be happy to give it to schools. It has a slightly bluish cast which enhances its appeal for students doing sea art for overhead projects.

Cardboard cartons: Local appliance stores: freezer or refrigerator cartons make small arks or ships.

Mail order stores: A second source for freezer or refrigerator cartons; also water heater cartons work well for sailing ships or long boats.

Funeral homes: Coffin cartons are a good size for combination sailing, ships reading corners.

Lumber and sawdust: Most lumber yards have a scrap bin which they are willing for teachers to salvage. This generally yields enough lumber for an average class project. Sawdust is available from the same source; it is best to take a large grocery bag or small carton to carry the sawdust.

REFERENCES

As a convenience to the volunteer using this project guide, the reference materials used in designing individual lessons are listed at the end of each lesson.

These references may be used for additional or more indepth information and many are available through Cooperative Extension, Sea Grant or New Jersey Marine Sciences Consortium.

For more information contact:

New Jersey Marine Sciences Consortium

Sandy Hook Field Station
Building #22
Fort Hancock, New Jersey 07732

Seaville Field Station
PO Box 549
Marmora, New Jersey 08223

New Jersey Sea Grant Extension Service Marine Agents:

Stewart M. Tweed
Cape May County
Dennisville Road, Rt.#657
Cape May Court House, NJ 08210

Gef Flimlin
Ocean County
Whitesville Road
Toms River, N.J. 08753

Or the 4-H Agent at your County Cooperative Extension Office.